SOCIO-ECONOMIC SURVEY
OF
SMALLHOLDER FARMING SYSTEMS IN SOLOMON ISLANDS

REEF ISLANDS
TEMOTU PROVINCE

Agricultural Economics Section
Rural Services Project
Ministry of Agriculture and Lands
Solomon Islands

April 1989

Table of Contents

List of Tables

List of Diagrams

Abbreviations and Units of Measure

AES	Agricultural Economics Section (RSP)
CEMA	Commodities Exporting and Marketing Authority
DCRS	Dodo Creek Research Station
MAL	Ministry of Agriculture and Lands
PBME	Project Beneficiary Monitoring and Evaluation (RSP)
RDC	Rural Development Centre (RSP)
RSP	Rural Services Project
km	kilometre = 1,000 m
ha	hectare = 10,000 sq m
m	metre
MT	metric tonne = 1,000 kg
SI$	Solomon Islands Dollar

Acknowledgements

The present report is produced by the staff of the Agricultural Economics Section. The Section was established under the ADB/IDA/IFAD assisted Rural Services Project and is engaged in a two years socio-economic study of smallholder farming systems throughout Solomon Islands, extending from 1987 to 1989.

Many others contributed to the planning of the programme and in its implementation. The study would not have been possible without the support and patience of local people. To them we are grateful and hope that the present report will be in some way of benefit.

We would like to thank members of the Ministry of Agriculture and Lands, in particular the Director of the Rural Services Project and staff, and the Chief Research Officer and staff for their support throughout.

The Statistics Office of the Ministry of Finance has assisted the survey through the generous lending of equipment, canoes and outboards, and in sampling. Thanks are especially due to Richard Harris, Rural Statistician, for his interest in the survey from the outset.

Not least, thanks are extended to the Premier of Temotu Province, the Provincial Secretary and staff, the Principal Field Officer and members of the agricultural extension service for their support in establishing the survey. It is especially hoped that the present report will find a practical application in development works being undertaken in the Province.

E. C. Mackey
Agricultural Economist

Agricultural Economics Section
Rural Services Project
Ministry of Agriculture and Lands
Solomon Islands

Chapter: 1
INTRODUCTION

1.1 The Solomon Islands comprise a double chain of islands extending in a north-west south-east direction over 860km of the south-west Pacific between latitudes 5^{o}-12^{o}S and longitudes 155^{o}-170^{o}E. The islands lie directly along a major line of crustal weakness traversing the western Pacific and are the surface expressions of fault-bounded blocks and troughs originating in a zone of geologically intense activity. Warping and block movement are the most significant geomorphic processes responsible for the elevation of land to its present altitude, with marine sediments occuring on some of the highest ranges. Such processes continue spasmodically and raised reefs at various heights occur in many parts of the country, as does intense faulting. Earthquakes are frequent and often initiate land movements in ground already close to shearing point such as saturated soil at the heads of steeply incised gullies, resulting in debris slides among the high ridges (10).

1.2 Solomon Islands lies well within the geographical tropics in an oceanic area where two contrasting trade winds meet, a low-pressure belt of ascending air known as the "inter-tropical convergence zone" (ITCZ). In this zone warm and humid air masses drawn from equatorial regions meet relatively cool and dry sub-tropical air derived from the south-east. From about March to November the islands experience steady, shallow, south-easterly winds. During November and December unsettled weather is likely as the ITCZ moves south over the islands, from which follows steady north-westerly winds. March and April are again unsettled as the ITCZ returns northwards until the south-easterly trade winds become re-established. Cyclonic disturbances may be generated, particularly around December and April when the convergence of the two air streams is strongest. Weather is varied, both temporally and spatially, but is characterised by continally high average temperatures and humitity. Most land areas have a mean annual rainfall of 3,000-5,000mm with variations depending on latitude and orientation to prevailing winds. Temperatures are more uniform, at around 26^{o}C in the lowlands, and never reach extremes which would restrict plant growth. Night time humidity exceeds 90%. This may fall to 60% on clear sunny days, or remain close to saturation point during cyclonic conditions (10).

Table: 1.1

SOLOMON ISLANDS KEY DATA

Province	Western	Ysabel	Central	Guadalcanal	Honiara
POPULATION					
1986 population	55,250	14,616	18,457	49,831	30,413
annual growth rate	3.0	3.2	2.9	4.3	6.8
% national population	19	5	6	17	11
peri-urban population	3,710	1,901	1,622		30,413
% peri-urban	7	13	9	38	
number of households	7,942	2,362	3,079	8,072	4,317
LAND AREA					
land area (sq km)	9,312	4,136	1,286	5,336	22
% land area	33	15	5	19	0
population density/sq km	6	4	14	9	1,382
1987 PROVINCIAL GOVERNMENT REVENUE AND EXPENDITURE (SI$'000)					
revenue	443	173	191	281	1,033
grants	2,556	634	623	1,247	704
current expenditure	3,504	849	750	1,431	1,561
capital expenditure	200	58	88	192	177
net revenue (negative)	(705)	(100)	(24)	(96)	(2)

Province	Malaita	Makira	Temotu	Total
POPULATION				
1986 population	80,032	21,796	14,781	285,176
annual growth rate	2.7	3.6	2.8	3.5
% national population	28	8	5	100
peri-urban population	3,252	2,588	1,295	44,781
% peri-urban	4	12	9	16
number of households	12,417	3,278	2,375	43,842
LAND AREA				
land area (sq km)	4,225	3,188	865	28,370
% land area	15	11	3	100
population density/sq km	19	7	17	10
1987 PROVINCIAL GOVERNMENT REVENUE AND EXPENDITURE (SI$'000)				
revenue	339	485	160	3,103
grants	1,891	1,095	445	9,195
current expenditure	2,190	1,472	615	12,371
capital expenditure	331	600	0	1,646
net revenue (negative)	(291)	(492)	(10)	(1,719)

Source: Statistics Office Statistical Bulletin 15/87 "Provincial Statistics"
Populationa data revised from Statistics Office Statistical Bulletin 3/88 "Solomon Islands Population Census"

POPULATION COMPOSITION

% by province

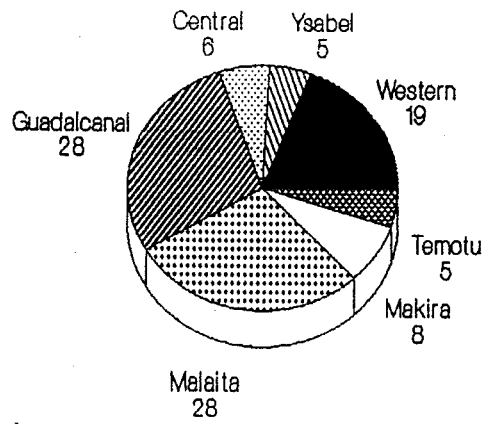


Diagram: 1.1

LAND AREA

% by province

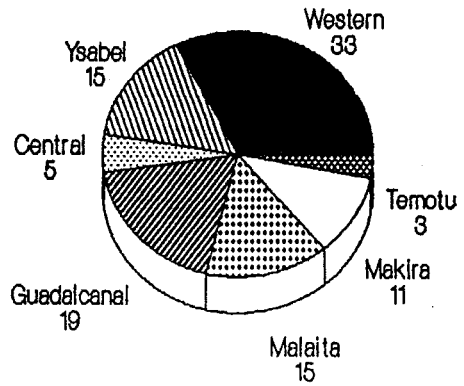


Diagram: 1.2

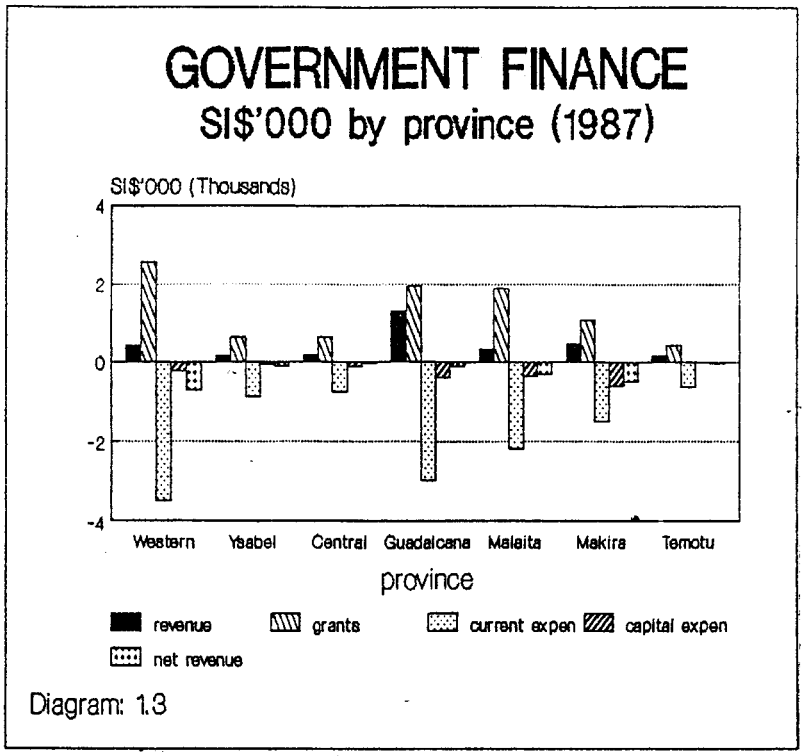


Diagram: 1.3

1.12 The Agricultural Economics Section (AES) was established under the Rural Services Project (RSP) inter alia in order to generate statistical information on smallholder production systems for the quantification of constraints to agricultural development and the devising of appropriate agricultural research programmes. The present study is part of a national survey programme to generate detailed base-line data on smallholder farming systems.

1.13 Since September 1987 AES has conducted a series of farming systems surveys in selected sites throughout the country, such as in the immediate areas of influence of Rural Development Centres or in other areas of special agricultural interest. It is intended that the findings of the survey will find application in the evaluation of development activities, and will assist in the assessment of changes taking place in Solomon Islands agriculture and the formulation of development strategies. The background and justification for the survey programme are documented in the AES Inception Report of 1987 [20]. Methodologies are described in the Agricultural Economics Field Survey Manual [21] and related documents produced by AES.

1.14 The Reef Islands survey in Temotu Province was undertaken at the request of the Premier and the staff of the Temotu Provincial Assembly. This arose from concern that population pressure within the atoll islands was putting farming systems under stress, causing land degradation and resulting in hardship among the inhabitants of the islands. This was excasserbated by damage to crops from Cyclone Annie. Consequently the Reef Islands faced a gap in the production cycle from around March to August 1988, awaiting the breadfruit harvest. The extent of cyclone damage, said to be most severe to the banana crop, was uncertain but the provincial authorities were providing staples from Santa Cruz at subsidised prices with freight charges covered by the Provincial Disaster Fund.

1.15 The Reef Islands is the only atoll system in the AES programme and includes a detailed study of soils. Concern has been expressed among the inhabitants of Reef Islands and extension workers that intensifying cropping, especially in sweet potato gardens, is resulting in soil degradation. Regretably soils results are not available at the time of reporting.

1.16 The survey, on the two main islands of Lomlom and Fenualoa, was conducted in May 1988 and covered 40 rural households. Two stage systematic random sampling was guided by the Statistics Office based on equal probability of household selection, with accessibility taken into account in the definition of the sample frame. Thus the outer Reef Islands were not included in the study. Villages were listed from the 1986 population census, and selected by systematic random sampling. A pre-determined number of households within each village (or cluster of small villages) were then selected by simple random sampling. Maps of the survey area are presented in diagrams 1.4 and 1.5.

1.17 The survey is designed to investigate the structure and dynamics of crop and management systems. It is clear that many farmers are on the margin of viability due to the fragmentation of holdings over generations, but not all farmers are facing severe problems yet. Of particular importance in the study has been an investigation of inequalities in holding size, stresses assoiciated with intensive cropping on small holdings, and an apparently increasing reliance on annual cropping as tree crop areas are cleared and lost.

1.18 All cultivated areas, including cropped and cleared land, are measured by tape and compass to an error tolerance of 5%. Crop areas are computed and checked in the field by programmable calculator. Data are processed in "dBASE III Plus" databases and analysed through "SPSS/PC+". Raw output is transferred to "Lotus 123 vr 2" spreadsheets for tabulation and secondary processing. Text tables are incorporated into "Wordstar Professional r 4" and graphics are edited in "Harvard Presentation Graphics".

1.19 Data processing and the presentation of results has been made possible by the generosity of the Government of New Zealand through its Miscellaneous Technical Assistance Programme. This has overcome a primary constraint to work of this kind in the Ministry of Agriculture and Lands through the provision of computing hardware.

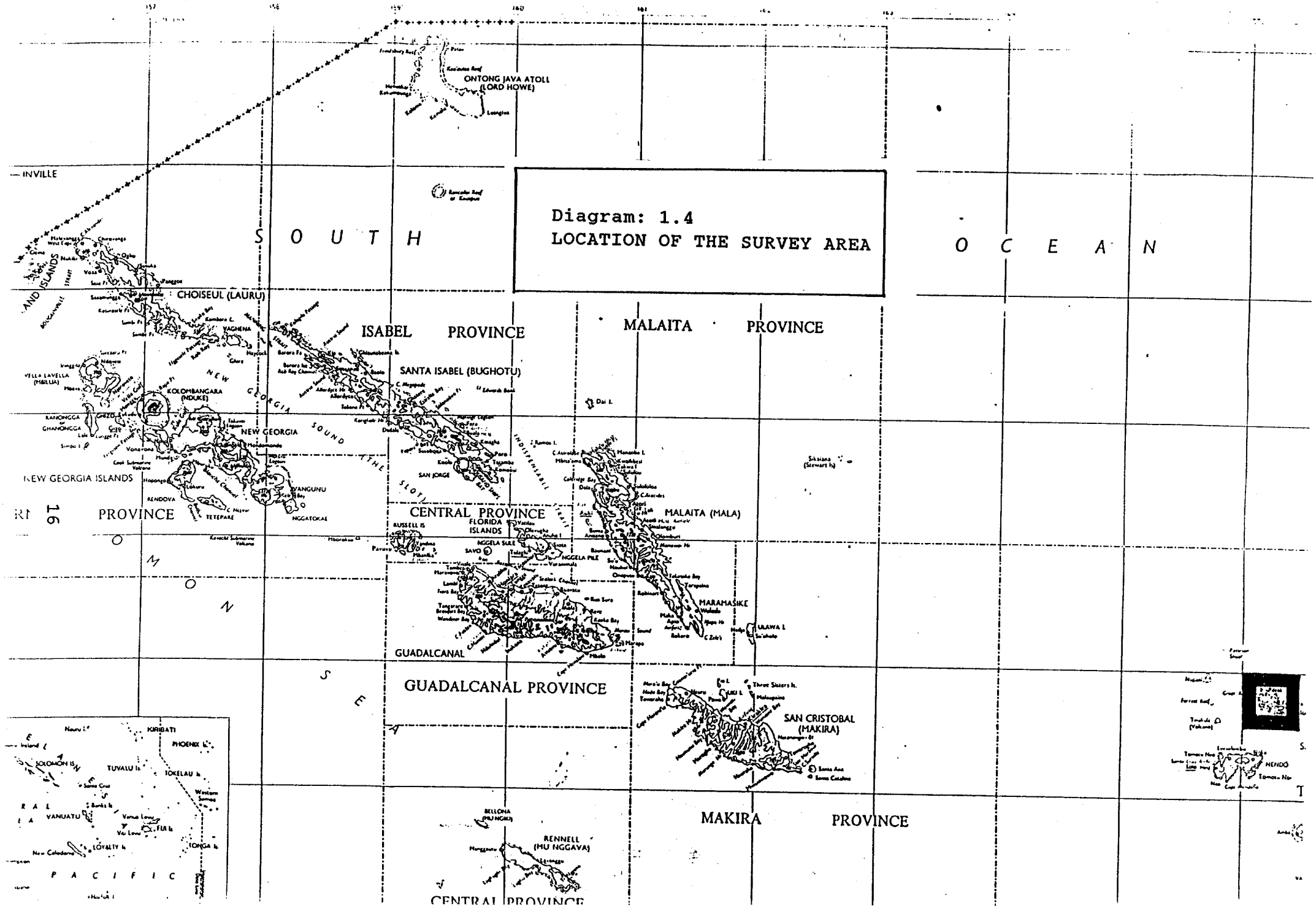
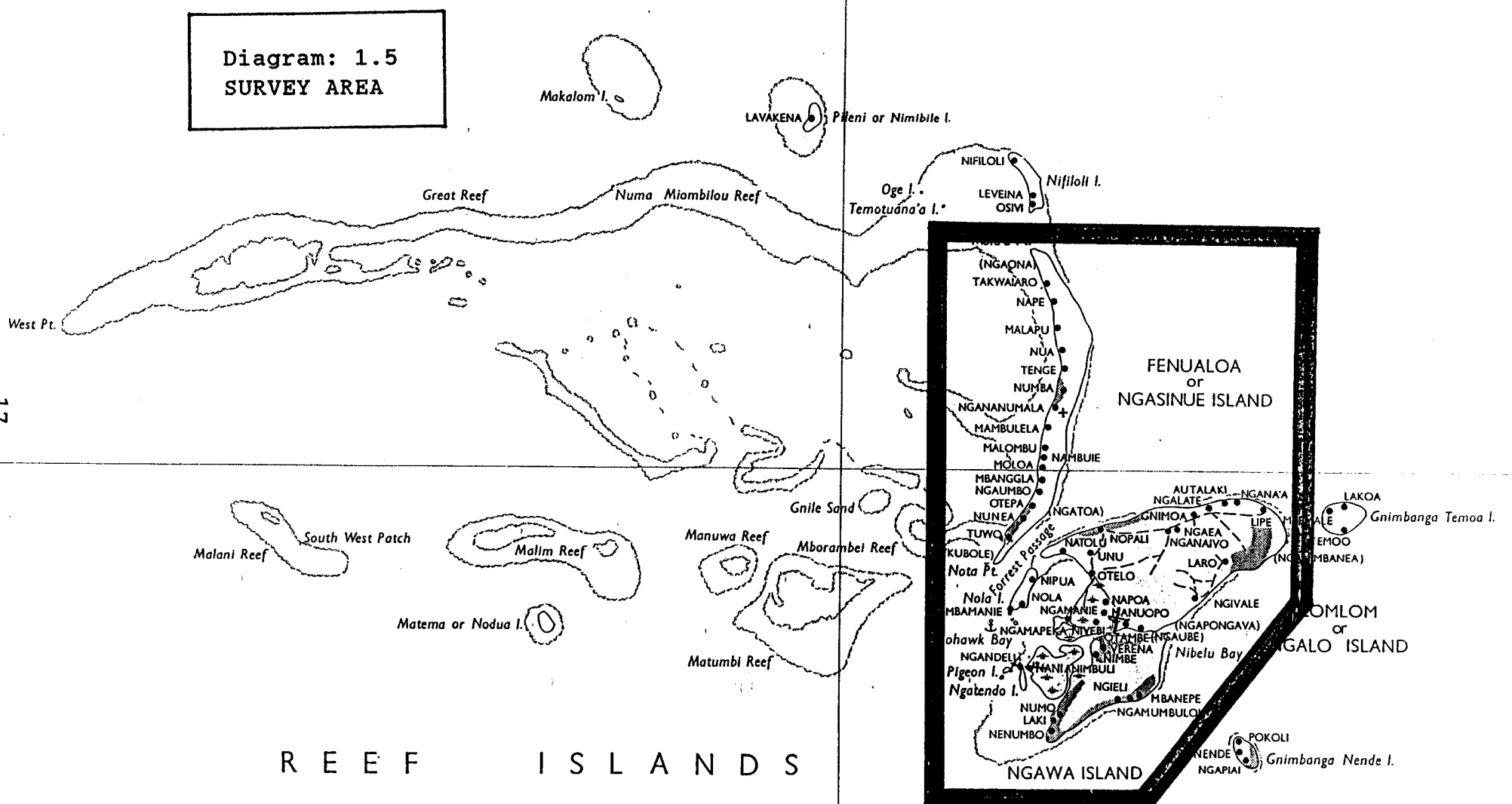


Diagram: 1.4
LOCATION OF THE SURVEY AREA
S O U T H
O C E A N
ONTONG JAVA ATOLL (LORD HOWE)
CHOISEUL (LAURU)
ISABEL PROVINCE
MALAITA PROVINCE
SANTA ISABEL (BUGHOTU)
KOLOMBANGARA (NDUKE)
NEW GEORGIA
NEW GEORGIA SOUND
NEW GEORGIA ISLANDS
PROVINCE
CENTRAL PROVINCE
FLORIDA ISLANDS
MALAITA (MALA)
MARAMASIKE
GUADALCANAL
GUADALCANAL PROVINCE
SAN CRISTOBAL (MAKIRA)
MAKIRA PROVINCE
RENNELL (MU NGGAVA)
BELLONA (MU NGIKA)
KIRIBATI
PHOENIX Is.
TUVALU Is.
TOKELAU Is.
VANUATU
TONGA Is.
P A C I F I C

Diagram: 1.5
SURVEY AREA



Chapter: 2
SUMMARY AND MAIN FINDINGS

Household Composition

2.1 The mean household size in the survey area is 6.98, comprised of 3.80 males to 3.18 females, or a ratio of 1.19:1 males to females.

2.2 The available labour composition of rural households in the survey area is **2.49male:1.99female**, or **56%** male to **44%** female out of a total of **4.48** adult equivalent labour units per household.

Income Earning Activities

2.3 The most important rural income earning activities in terms of households earning income are the sale of copra, fish, livestock and food crops. **36%** of households are engaged in copra marketing, **26%** in the sale of livestock and **23%** in the sale of food crops. Livestock sales are mostly pigs, and to a lesser extent chickens. Cash crops such as dried breadfruit are also important, with **15%** of households selling cash crops other than copra. **33%** of households earn income from the sale of fish and **3%** from the sale of shellfish.

2.4 Income from retail trade is widespread. **49%** of households are earn income from cooperative shops and **26%** earn income from private shops. **10%** have a skilled trade or profession. No logging or mining activities are conducted.

Extension and Mass Media

2.5 **49%** of households listen to agricultural programmes on the radio, although only **18%** listen regularly. Written materials may be more appropriate extension media than has been supposed since it is found that **69%** of households have at least one member with some reading and writing ability. The survey does not, however, verify this result or investigate the quality of such skills. **51%** of households have been visited by extension although **36%** are infrequent visits. **33%** of households have attended agricultural training, mostly in the form of village meetings.

Livestock

2.6 Livestock, predominantly pigs and chickens, are an important component of smallholder farming systems. all of households own pigs with a mean herd size of 3.69 among owners. Chickens are kept by 59% of households with a mean flock size of 9.35 among owners. Ducks are owned by 5% of households with a mean flock size of 3.00 among owners.

2.7 3% of households own goats with a mean herd size of 10.00 among owners.

Holding Size Distribution

2.8 One farmer with a holding size of 23.764ha was excluded from the analysis because this would have distorted results to an extent which would have obscured any valid conclusions about the farming systems of Reef Islands. The excluded holding has been studied elsewhere [31] and AES results are available if required in the future. The mean holding size on the remaining 39 households is 0.428ha. While the range of holding sizes is small, with a maximum of 1.542ha, the majority of farmers have very small holdings and 74% of farmers have holdings of less than 0.5ha.

2.9 36% of farmers have no coconut plantings and have a mean holding size of 0.153ha. The mean holding size among farmers with coconuts is 0.583ha. Development proposals for the Reef Islands must take account of very small holding sizes which result from a high population density on a limited land area.

Labour Density

2.10 A high proportion of holdings are becoming unviable as a result of fragmentation over generations. The mean labour availability is 4.48 adult equivalent labour units per household, resulting in a mean labour density of 10.46 labour units per hectare. Although larger holdings tend to have more labour available, labour density per unit area falls from 28.24 labour units per hectare on holdings of less than 0.25ha in size to 1.30 labour units per hectare on holdings in the range 1.5 - 1.75ha. On non-tree cropping holdings the mean labour density is 28.41 labour units per hectare compared with 7.81 labour units per hectare on tree-crop holdings.

Cropping Patterns

2.11 The average holding size is 0.429ha. Of households with tree crops the mean holding size is 0.58ha, of which 0.44ha is mostly under coconuts and 0.14ha is food crops. Non-tree crop farmers have a mean holding size of 0.15ha under food crops. Smallholder cropping patterns are complex and diverse, with 12 dominant crops recorded and a total of 65 distinct mixtures. The "traditional" gardens of mixed perennial crops, well suited to Reef Islands soils, are becoming lost to annual cropping as a result of land pressure. Soils are becoming degraded and productivity is declining.

Coconut

2.12 63% of sampled farmers have grow coconuts[30] and 36% earn income from copra. Coconut is a crop of majot economic importance in the Reef Islands, despite marketing problems, but is putting further pressure on the tree resources of the islands as a result of the need for firewood in the curing of copra.

2.13 Almost all coconuts are local tall and in mature stands. Only 7% are less than 16 years of age, 90% are aged 17 - 40 years and 3% are senescent.

2.14 73% of coconut plantings are pure stand and 27% are intercropped with food or tree crops. 6% are undercropped, 18% brushed to ground level, 42% brushed to shoulder height and 33% are in mixed stands with other trees.

Soil Fertility and Fallow

2.15 Fallow and tree cover are especially important in the Reef Islands for the the maintenance of soil fertility under annual cropping. The fertility of Reef Islands soils is largely determined by the amount of organic matter present, which acts as a store of nutrients and moisture. Under tree cropping organic matter accumulates and soils remain rich and fertile. When cleared for annual cropping yields are initially high under the mineralising flush of nutrients, but decline rapidly as soils become degarded with the loss of organic matter. Such soils are appropriately termed "dry" in Reef Islands.

2.16 On gardens where it is known, there is a fallow period of 5.9 years, but **48%** of gardens have a fallow longer than memory. Root crops are typically grown over 2 to 3 harvests before reverting to fallow.

2.17 **18%** of food gardens have a fallow of secondary forest extending over **17%** of the food garden area, but most fallow is dense shrubby thicket extending over **59%** of food gardens and **51%** of the food garden area. **21%** of food gardens are cleared from former tree crops land extending over **34%** of the food garden area. There is a rapid destruction of tree cropping, which is stable and sustainable, in favour of annual cropping. This provides good returns in the short term, but is leading to the degradation of soils in the Reef Islands and is now exacerbating problems further as soils become degraded over wide areas.

Landform

2.18 **37%** of the coconut area is on beach sites and **63%** is on the inland coraline platform. **17%** of the food garden area is on beach sites and **83%** on the inland coraline platform.

2.19 The mean distance of gardens from households is .181 hours, with a maximum recorded distance of **1.05** hours.

Adverse Factors Affecting Production

2.20 **29%** of gardens representing only **24%** of the cultivated area have no major site limitations. Poor soil is regarded as a constraint on **48%** of gardens (**42%** of area); pests and disease are a problem on **39%** of gardens (**36%** of area); weeds and related factors are a problem on **22%** of gardens, but **42%** of the cultivated area.

Crop Yields

2.21 Production data are limited and so estimated indicative yields only are presented in table 2.1.

Table: 2.1
SMALLHOLDER CROP YIELDS

crop	condition	yield kg/ha
coconut	copra equivalent	800
sweet potato	) 8 years fallow	5,000
	4 - 8 years fallow	3-5,000
	(4 years fallow	1-3,000
taro		5,000
pana		3-5,000
cassava		5,000

Text source: Table 14.5

Labour

2.22 With high labour densities, labour is regarded as a constraint on only **9%** of tree gardens representing **9%** of the tree garden area and **8%** of food gardens representing **17%** of the food garden area.

2.23 A shortage of inputs or cash is recorded on **38%** of the tree gardens representing **28%** of the tree garden area. **15%** of annaul crop gardens have a shortage of inputs or cash affecting **34%** of the food garden area. Distance to gardens is not a problem.

2.24 Labour expenditure on the average holding is summarised in table 2.2 - presented firstly by crop (aggregating all operations), and secondly by operation (aggregating all crops).

Table: 2.2
LABOUR SUMMARY

	(------ work days per year -----) (----- per holding -----)				per ha	(- % contribution -)			labour cost
	men	women	paid	total	average	men	women	paid	(I)
i) By Crop									
Cleared land					80				
Coconut	53	10		63	256	84	16		
Fruit trees					174				
Nut trees	2			2	122	100			
Sugar cane					12566				
Food/building tree	3	1		4	328	75	25		
Sweet potato	62	179		241	2465	26	74		
Pana	35	63		98	2413	36	64		
Cassava		1		1	506		100		
All Crops	155	254		409	2171	38	62		
ii) By Operation									
Land Clearance	26	6		32		81	19		
Cultivation	27	10		37		73	27		
Planting	18	13		31		58	42		
Tree Crops Establishment	3			3		100			
Tree Crops Maintenance	4			4		100			
First Weeding	10	15		25		40	60		
Second Weeding	11	15		26		42	58		
Third Weeding	5	4		9		56	44		
Harvesting	51	191		242		21	79		
All Operations	155	254		409		38	62		
Available labour units	:2.49	1.99							
Days per unit labour	: 62	128							

Text source: Table 16.3

2.25 Sweet potato accounts for **59%** of the holding labour budget with a requirement of **241** work days per year. Pana requires a further **98** work days per year, and coconut required 63 work days. Men provide **84%** of the labour on coconuts and around **30%** of the labour on root crops, while women provide **16%** of the total labour on coconuts and about **70%** of the labour on root crops. Overall men contribute **38%** of labour and women provide **62%**.

2.26 Harvesting is dominant in the labour budget. Men provide most labour on clearance, cultivation and tree crops maintenance while women provide most labour on the weeding and harvesting of root crops.

2.27 Overall there are 409 work days required per year on the average holding, of which 155 are provided by men and 254 by women. The average adult man in the household spends 62 days working on the holding and the average adult woman spends 128 days.

Cash Crop Processing

2.28 While 62% of farmers grow coconuts only 36% earn income from the sale of copra. The labour input in the manufacture of copra is 77% family and 23% hired, at an annual cost of SI$8.1. Copra production is labour intensive, requiring on average 191 work days per annum to produce 602kg copra, or one work day per 3kg copra produced. At the prevailing price of 33 cents per kilo this offers a net return of SI$1.27 per household work day. The net mean annual income from copra is SI$182.

Marketing

2.29 Crops are generally sold locally or to intermediate markets. Most crop sales are copra, root crops, fruit crops and nuts crops. Prices are generally felt to be poor and are the dominant problem expressed by farmers.

Chapter: 3
HOUSEHOLD COMPOSITION

3.1 The analysis of household composition in the survey sets production and management information in a social context, establishes labour availability, and is used to assess the degree of population pressure on farming systems. Recent demographic data from the 1986 census are summarised in table 3.1 (1).

Table: 3.1
POPULATION CHARACTERISTICS
(from the 1986 census)

Province	Western	Ysabel	Central	Guadal	Honiara	Malaita	Makira	Temotu	Total
1986 population	55,250	14,616	18,457	49,831	30,413	80,032	21,796	14,781	285,176
annual growth rate	3.0	3.2	2.9	4.3	6.8	2.7	3.6	2.8	3.5
% national population	19	5	6	17	11	28	8	5	100
peri-urban population	3,710	1,901	1,622		30,413	3,252	2,588	1,295	44,781
% peri-urban	7	13	9	38		4	12	9	16
males	29,202	7,329	9,850	26,251	17,293	39,605	11,174	7,268	147,972
females	26,048	7,287	8,607	23,580	13,120	40,427	10,622	7,513	137,204
sex-ratio	112	101	114	111	132	98	105	97	108
number of households	7,942	2,362	3,079	8,072	4,317	12,417	3,278	2,375	43,842
household size	6.96	6.19	5.99	6.17	7.04	6.45	6.65	6.22	6.50
Age composition (%)									
0 - 14	46.4	48.8	45.7	46.8	39.2	50.2	50.7	49.6	47.3
15 - 29	27.2	22	26	27.2	35.7	21.7	23.3	23.3	25.8
30 - 44	13.5	13.9	14.4	14	17.1	13.2	13.1	13.3	13.9
45 - 59	8	8.5	8.2	7.3	5.8	9.1	8.2	8.5	8.1
60 +	4.9	6.7	5.7	4.6	2.1	5.7	4.6	5.5	4.9

Source: Statistics Office Statistical Bulletin 3/88

3.2 In November 1986 the population of Solomon Islands was 285,176 with an annual growth rate of 3.5%. The national mean household size was 6.5, resulting in a total of 43,842 households, of which at least 84% are rural. Guadalcanal, Malaita and Western Provinces account for 77% of the national population.

3.3 The age composition of the Solomon Islands population is young with a wide based, tapering population pyramid. The "dependency ratio" (the number of persons under 15 years and over 60 years of age per 100 persons aged 15 to 59 years) is 109[2].

3.4 The total fertility rate is 6.4 children per woman at the end of her child bearing age. The life expectancy at birth among males is 59.9 years, and among females is 61.4 years. Male infant mortality is 40 per thousand live births compared with a female infant mortality of 36 per thousand live births[2].

3.5 In the census 40,046 persons attended school during 1986, although some disruption was caused by Cyclone Namu. Among all persons aged 5 years and over not attending school in 1986, 51% had no education. Primary school attendance spans a wide age range, but 20% of age group 10 to 24 never attended school.

3.6 94.2% of the Solomon Islands population is Melanesian, 3.7% Polynesian and 2.1% other ethnic groups, but mainly Kiribati. 17% of the census population were residing in a province other than that of their birth, indicating a considerable level of internal migration. Onward movement is particularly strong from Malaita, resulting in net out-movement. This is true for provinces other than Central and Guadalcanal which experience a net in-movement. All provinces showed a net movement to Honiara.

3.7 The population of Reef Islands was as follows:

POPULATION OF REEF ISLANDS IN 1986:

	households	males	females	total
Fenualoa	163	512	565	1,077
Nipua/Nopali	118	361	389	750
Lipe/Temoa	104	313	375	688
Manuopo	134	448	457	905
Nenumpo	148	431	518	949
Reef Islands	667	2,065	2,304	4,369
Temotu	2,375	7,268	7,513	14,781
%	28	28	31	30

Source: Statistical Bulletin 3/88[1]

3.8 Reef Islands, despite their small area of 29 sq km, account for 30% of the Temotu Population. The population density of Reef Islands is ten times that of the province as a whole, with 177 persons per sq km compared with a provincial average of 17 persons per sq km, exceeded in the province only by Tikopia[11]. This makes Reef Islands among the most densely populated parts of the country.

3.9 Household composition results from the farming systems survey are summarised in table 3.2. Age categories are chosen to provide approximate conversion into "available labour units". The membership of a household often includes relatives, and less commonly non-relatives (these are both referred to as "relatives" in the table), and both family and non-family members define the "de facto" household size. This is the actual number of people residing in the household and is illustrated in diagram 3.1. A second measure of household composition is the number of immediate family members (father, mother, sons and daughters) either living at home or living away. This is known as the "de jure" family size.

3.10 In the survey area the average family size is 8.29 which is high by national standards. With 25% of family members living away from home, a household has on average 6.98 members, of which 6.28 are immediate family and the remainder relatives or others residing in the household.

3.11 Those living away are mostly in the economically active age group 16 - 55. Of 4.50 male family members 3.39 live at home, representing a net onward movement of 25% among male family members. This is not compensated for by non-family male household members, since there are only 3.80 males in the household.

3.12 Of 3.79 female family members 2.89 live at home, representing a 24% onward movement. As with males, this is not compensated for by additional non-family female members living in the household since there are altogether 3.18 female members of the household.

Table: 3.2
HOUSEHOLD COMPOSITION
(from the farming systems survey)

Mean Number of Household Members:

MALE					AGE GROUP	FEMALE				
living at HOME			AWAY			living at HOME			AWAY	
Head	Family	Relative	Family			Head	Family	Relative	Family	
0.13		0.03			> 55		0.05			
0.87	0.92	0.23	1.00		16 - 55		1.56	0.13	0.90	
	1.08	0.15	0.08		6 - 15		0.87	0.03		
	0.36		0.03		2 - 5		0.36	0.13		
	0.03				0 - 1		0.05			total
Category total:	1.00	2.39	0.41	1.11			2.89	0.29	0.90	8.99
Family at home:		3.39					2.89			6.28
De Facto total:			3.80					3.18		6.98
De Jure total :				4.50					3.79	8.29

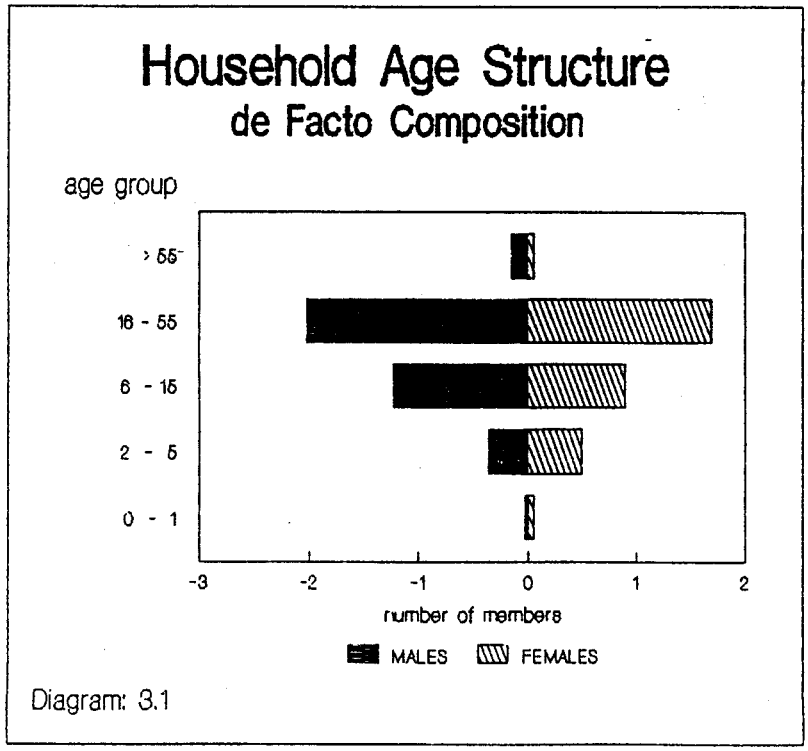


Diagram: 3.1

3.13 De facto household composition is converted into "adult equivalent labour units" in table 3.3 according to factors employed by Bathgate[18] (although there are slight differences in age classes between the two studies). An average household of **4.48** labour units is made up of **2.49** male units and **1.99** female units. Due to differences in age and numbers, men account for **56%** of household available labour compared to **44%** from women.

Table: 3.3
HOUSEHOLD LABOUR AVAILABILITY

Mean number of members by age group:

MALES de Jure	MALES de Facto	MALES labour	AGE GROUP	FEMALES de Jure	FEMALES de Facto	FEMALES labour	TOTAL de Jure	TOTAL de Facto	TOTAL labour
0.13	0.16	0.09	› 55	0.05	0.05	0.03	0.18	0.21	0.12
2.79	2.02	2.03	16 - 55	2.46	1.69	1.69	5.25	3.71	3.72
1.16	1.23	0.37	6 - 15	0.87	0.90	0.27	2.03	2.13	0.64
0.39	0.36		2 - 5	0.36	0.49		0.75	0.85	
0.03	0.03		0 - 1	0.05	0.05		0.08	0.08	
Total 4.50	3.80	2.49		3.79	3.18	1.99	8.29	6.98	4.48

Labour availability assumes the following conversion factors:

age class	factor
› 55	0.6
16 - 55	1.0
6 - 15	0.3
0 - 5	0.0

Chapter: 4
INCOME EARNING ACTIVITIES

4.1 2.5% of rural households in the country were enumerated in the 1982 Household Income and Expenditure Survey [3] conducted by the Statistics Office of the Ministry of Finance. Virtually all rural households had food gardens. **39%** sold copra and **41%** sold garden produce, with an average monthly income from sales of **SI$56**. A summary of income earning activities from the 1982 and the 1986 population census is presented in table 4.1.

Table: 4.1
1982 INCOME AND EXPENDITURE SURVEY: SALES

activity	% households earning income	
	1982	1986
copra	39	29
coconut	18	
cocoa	0.38	9
betel nut	1.25	17
other cash crop	12	
garden produce	41	34
cattle		2
pigs		12
poultry		10
fish	24	17
crabs, lobster		4
beche de mer		12
shells	7	
carvings	4	
hand crafts	0.38	4
canoes		3
mats, baskets		10
thatch		4
houses		5
other sales	1.13	

Source: Statistics Office Natioanl Accounts Discussion Document No 2
Statistics Office Bulletin 12/88

4.2 These figures show the importance of garden produce sales as an income earning activity, although the relative magnitude of earnings is not known. Copra is the major cash earning commodity, showing an apparent contraction in the proportion of rural sales. By contrast cocoa sales have expanded.

4.3 In the 1982 survey **27%** of rural households had at least one

member in paid employment, from which the average monthly wage was SI$103. 16% had their own business and 39% of households had a share in a cooperative (although it is stated that this result should be treated with caution). 10% of households held a loan, with an average monthly repayment of SI$87, the majority with the Development Bank of Solomon Islands.

4.4 On average a household spent SI$57 per month on goods and services of which 47%, or SI$27, was on food. Less frequent expenditures amounted to SI$5 per month.

4.5 Reported (cash and non-cash) income was SI$147 compared to monthly expenditures of SI$131. The average cash component of income amounted to SI$86 per month compared with expenditures of SI$74. The excess of 17% in income over expenditure was believed to be due to the underestimation of production costs rather than the true value of rural savings.

4.6 The 1986 census [2] found that 25% of the population aged 14 years and over was working for money (the week before the census enumeration), and about half of those also performed village work such as track clearing and church construction. About 80% of those not engaged in cash employment performed village work.

4.7 35% of males were engaged in cash employment compared with 13% of females. The 1982 Household Income and expenditure survey also states that "generally boys had a better chance of attending school than girls".

4.8 The rural economy is diverse, with a variety of farm and off-farm activities which may contribute to household income. Results from the farming systems survey are presented in table 4.2. The table describes the proportion of households undertaking income earning activities in the survey area.

Table: 4.2
INCOME EARNING ACTIVITIES

	⟨---- % households ----⟩ by activity individual	group	summary of individual activities
Households Earning Income Over the Past Year From:			
COCONUTS			
Coconuts			
Copra	36	36	++++++++++++++++
Coconuts and Copra			
Total	36		
COCOA			
Wet beans			
Dry Beans			
Wet and Dry Beans			
Total			
OTHER CROPS			
Food Crops	15	23	+++++++
Other Cash Crops	8	15	+++
Food and Cash Crops	5		++
Livestock	23	26	++++++++++
Food crops and Livestock			
Cash Crops and Livestock			
Food, Cash Crops and Livesock	3		+
Total	54		
FISHING			
Fish	31	33	+++++++++++++++
Shellfish		3	
Fish and shellfish	3		+
Crabs, etc			
Fish and Crabs			
Shellfish and Crabs			
Fish, Shellfish and Crabs			
Total	33		
LOGGING/MINING			
Logging			
Sawmill			
Logging and Sawmill			
Mining			
Logging and Mining			
Sawmill and Mining			
Logging, Sawmill and Mining ..			
Total			

INCOME EARNING ACTIVITIES (continued)

	⟨---- % households ----⟩ by activity		
	individual	group	summary of individual activities
PROFESSION			
Teacher			
Government Employee			
Other Profession			
Total			
COOPERATIVE			
Crop Production Cooperative ..	5	5	++
Marketing Cooperative			
Crop and Marketing			
Cooperative Shop	49	49	++++++++++++++++++++++++
Crop and Shop			
Marketing and Shop			
Crop, Marketing and Shop			
Total	54		
BUSINESS			
Private shop	26	26	++++++++++++
Vehicle Hire			
Shop and Vehicle			
Crafts			
Shop and Crafts			
Vehicle and Crafts			
Shop, Vehicle and Crafts			
Total	26		
SKILLED TRADE			
Joiner/housebuilder	3	3	+
Mechanical Trade	3	3	+
Joiner and Mechanical			
Other Skilled Trade	10	10	+++++
Joiner and Other			
Mechanical and Other			
Joiner, Mechanical and Other .			
Total	16		

4.9 In the table are two columns, entitled "individual" and "group". Individual activities distinguish between combinations of activities - treating for instance "food crops" (only), "livestock" (only) and both "food crops and livestock" as three distinct activities. The percentages of households for individual activities are additive, and are shown as a "total" for each set of related activities in the table.

4.10 Under group activities - all occurrences of "food crops" and all occurrences of "livestock" are summarised under the two main headings, since "livestock" and "food crops and livestock" are both livestock activities. "Group" activities represent an alternative summary for the data set, and are non additive.

4.11 To the right of table 4.2 is a histogram summary of individual activities. Diagram 4.1 provides a visual summary of grouped activities.

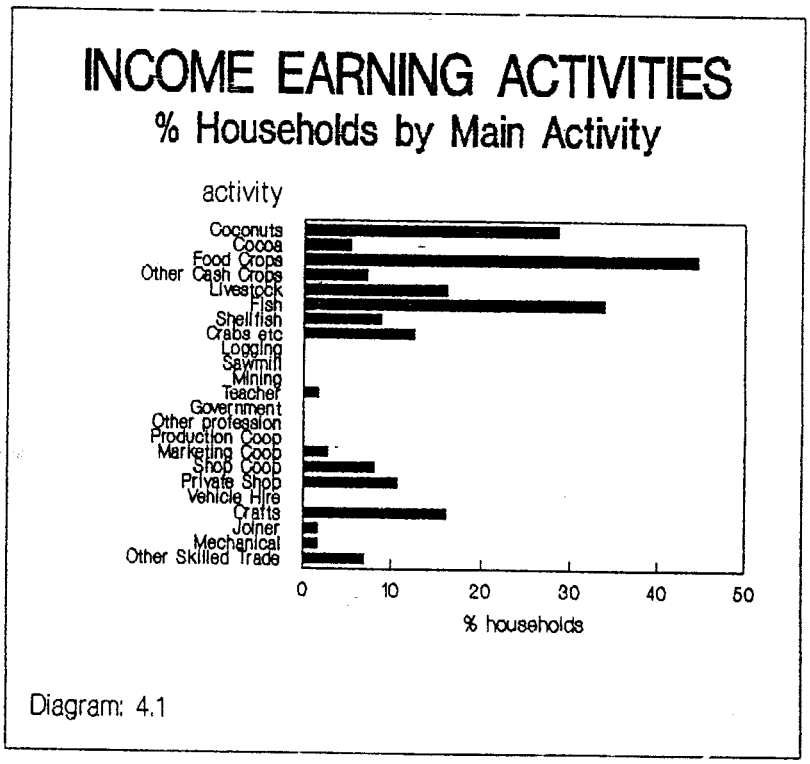


Diagram: 4.1

Chapter: 5
EXTENSION AND MASS MEDIA

5.1 Table 5.1 summarises the penetration of mass media and extension in the survey area.

Table: 5.1
EXTENSION AND MASS MEDIA

	% households	summary
i) Households Listening to Agricultural Programmes on the Radio:		
Never listen	51	++++++++++++
Listen weekly	10	++
" monthly	8	+
" occasionally	31	+++++++
Total	100	
ii) Households with Members who can Read and Write:		
Not able to read or write	26	++++++
Able to read	3	.
" write	3	.
" read and write	69	++++++++++++++++
	100	
iii) Households Visited by (any type of) Extension Worker:		
Never been visited	49	++++++++++++
Visited very occasionally	15	+++
" once per year	21	+++++
" " " 6 months	5	+
" " " 3 months	3	.
" " " month	8	+
" " " week		
Don't know		
	100	
iv) Households in which Members have Attended Training:		
Never attended training	67	++++++++++++++++
Attended village meeting	26	++++++
" day course at training centre	3	.
" village meeting and day course		
" residential course	5	+
" village meeting and residential course		
" day and residential course		
" village meeting, day and residential course		
	100	

5.2 Travel and communication are difficult in Solomon Islands, with many scattered islands. Radio offers a means of communicating throughout the country, albeit one-way, and in a medium which makes few demands on literacy. In the survey only 18% of households regularly listen to agricultural programmes on the radio, either weekly or monthly. 31% listen occasionally but 51% never listen to agricultural programmes. With only 49% of households listening to agricultural programmes the effectiveness of radio as a medium for communicating agricultural and other development information is no doubt extended through the transmission of messages by word of mouth. Problems experienced in the field include access to working radios, reception, and the ability among farmers to set aside time to listen to programmes.

5.3 The second part of the table shows the pproportion of households in which at least one member is able to read or write. According to these results 69% of households have at least one member with some reading and writing skills. The survey was unable to verify the level of skills or to substantiate this finding objectively, but the result suggests that simple written materials are an appropriate extension medium. In more general terms, pictural materials would be popular together with simple text and annotation.

5.4 The frequency of extension visits is investigated in the third part of the table, and is illustrated in diagram 5.1.

5.5 Extension in the present study refers to any agricultural worker in government extension, research, NGOs or other organisations. **16%** of households are visited regularly at least twice per year, with **8%** visited monthly or weekly.Overall **51%** of households have been visited by extension workers.

5.6 The fourth part of table 5.1 describes agricultural training. **33%** of households have participated in agricultural training, mainly in the form of village meetings. **5%** of farmers have been involved in residential training and **3%** have attended day courses at training centres.

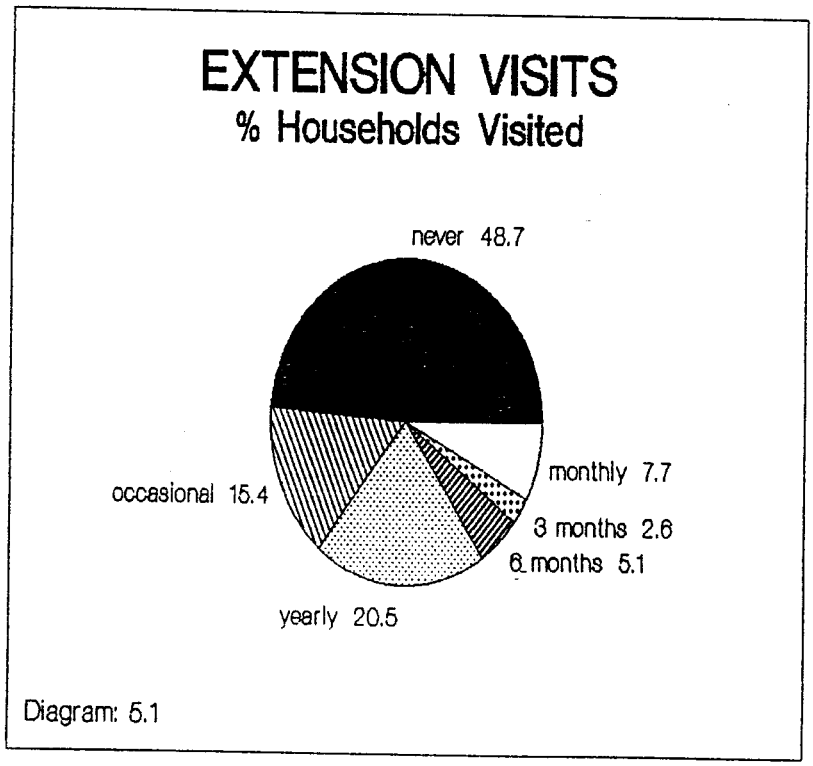


Diagram: 5.1

Chapter: 6
LIVESTOCK

6.1 Livestock, particularly small stock such as pigs and chickens, are an important feature of smallholder agriculture in Solomon Islands.

6.2 In the 1982 Income and Expenditure Survey [3] it was found that 37% of households owned pigs, 30% owned chickens, but only 8% owned cattle. The 1985 cattle census [4] recorded a national herd of 19,750, a fall of 13.1% from 1984 largely due to destocking in ther plantation sector. The smallholder sector accounted for 7,612 cattle, 39% of the national herd, and showed a decline of 4.1% from the 1984 cattle census. A summary of livestock ownership is presented in table 6.1.

Table: 6.1
LIVESTOCK DISTRIBUTION IN 1982

Province	% households owning		
	cattle	pigs	chickens
Western	2	19	24
Ysabel	42	25	47
Central		28	7
Guadalcanal	2	63	41
Malaita	9	35	28
Makira	10	69	63
Temotu		40	4
Total	8	37	30

Source: Statistics Office, 1982 HH Income and Expenditure Survey [3]

6.3 Table 6.2 summarises livestock ownership in the survey area, and is divided into three columns. The first, entitled "ownership %", specifies the percentage of households which own livestock. The middle two columns show mean stock held: firstly among livestock owning households (owners); and secondly as an average of all farmers in the survey area (both owners and non-owners). To the right of the table is a histogram summary of ownership based on the mean among all farmers.

6.4 The table is divided horizontally into three main parts. The first part specifies stock numbers kept predominantly for home use, but which may include occasional sales. The second part specifies stock numbers where livestock comprise an income earning enterprise. The third part is the overall mean of livestock ownership irrespective of type of enterprise.

6.5 At the foot of the table is a component on novel livestock enterprises, such as bees, butterflies and crocodile farming, however, these activities were not encountered.

Table: 6.2
LIVESTOCK

Livestock Ownership:

	ownership %	(-- mean ownership among owners	--) all farmers	summary all farmers
i) Home Use				
Cattle				
Pigs	100	3.69	3.69	++++++++++++++
Goats	3	10.00	0.26	+
Chickens	59	9.35	5.51	++++++++++++++++++++++
Ducks	5	3.00	0.15	.
Horses				
ii) Commercial				
Cattle				
Pigs				
Goats				
Chickens				
Ducks				
Horses				
iii) Total				
Cattle				
Pigs	100	3.69	3.69	++++++++++++++
Goats	3	10.00	0.26	+
Chickens	59	9.35	5.51	++++++++++++++++++++++
Ducks	5	3.00	0.15	.
Horses				

iv) Households Earning Income	(---- % households by activity ----) individual	group
Income from:		
1. Bees or honey		
2. Butterflies		
3. Bees and Butterflies		
4. Crocodiles		
5. Bees and crocodiles		
6. Butterflies and crocodiles		
7. Bees, butterflies and crocodiles ..		

6.6 While there are no commercial livestock enterprises, "home use" does not preclude occasional sales and **26%** of households earned income from the sale of livestock (table 4.2).

6.7 The most important livestock in the survey area are pigs and chickens. 3% (1 in the sample) of farmers own goats with a mean herd size of 10 head. No farmers own cattle.

6.8 Pigs play a role in all important social events and are a symbol of social status in the society. In some cases each family member owns a pig. Pigs are kept mainly for traditional feasts such as at weddings, for the settlement of disputes and as compensation when customs are violated. Pigs are also kept for home consumption and increasingly as a source of income from sales. Pigs rank among copra and dried breadfruit as a source of income. They are sold, within Reef Islands and to Lata, throughout the year but especially towards Christmas time. In the survey area all farmers keep pigs, with a mean herd size of 3.69.

6.9 Pigs are kept outside the village, along the sea shore, among the mangroves, or in bush areas. They are commonly tethered or are kept in pens made from stone or wood, but pigs are also allowed to forage away from food gardens during the day. In some villages families build large communal pens but this practice is dying out. Shelter is generally provided only for nursing sows.

6.10 Traditionally pig management is the woman's role, but now it is usual for any of the family members take responsibilities, including men and children. Decision making may belong to the household head, or to the owner of the pig. Pigs must be feed in the morning and again in the evening. They are generally fed kitchen scraps, cooked crop residues and coconut meat, and rain water is made available in collection vessels. The time spent in tending pigs is minor in relation to garden work.

6.11 In breeding, farmers look for desirable qualities such as good size and growth, or good mothering characteristics but breeding management is not strictly controlled. Often a boar will be borrowed from another farmer in return later for a piglet.

6.12 Chickens are of lesser importance in the traditions and lives of local people and are not used in ceremonial functions. They are largely kept for food and provide meat and eggs, although sales are not common. Chickens are kept by **59%** of households with a mean flock size of 9.35 among owners. Chickens generally require little or no management and are left to range free, being fed occasional kitchen scraps.

6.13 Ducks are of minor importance, owned by 5% of households with a mean flock size of 3 among owners. As with chickens, ducks are kept under minimal management.

Chapter: 7
HOLDING SIZE DISTRIBUTION

7.1 Holding size distribution is of interest because it provides an understanding of the structure of agriculture and may help to explain constraints faced by farmers. This is especially true in the Reef Islands where farming systems are coming under stress.

7.2 Table 7.1.i describes the holding size distribution of the survey area. One holding, with a size of **23.764ha** has been excluded from all analyses because it would otherwise distort findings to an extent that would make it impossible to draw valid conclusions from survey results.

7.3 Holdings are small, with a mean size of only **.428ha**. The distribution is spread fairly normally with a median holding size of **0.304ha** and a maximum of **1.542ha**. The distribution is slightly skewed, in that a high proportion of farmers have very small holdings. **74%** of farmers have holdings less than **0.5ha** in size. The holding size distribution is shown in diagram 7.1.

7.4 The holding size distribution may be viewed in standard form in diagram 7.2. The diagonal represents the holding size distribution for equality and the curve below represents the actual (cumulative) holding size distribution. The area between the diagonal and the curve is the "area of inequality". The larger the area of inequality, the more unequal the holding size distribution. This may be expressed as an index, called the "Gini coefficient", which is the area between the two lines expressed as a proportion of the area of the triangle below the diagonal. The Gini coefficient ranges from 0 (for perfect equality) to 1 (for perfect inequality). The Gini coefficient here is **0.4**, indicating a low degree of inequality.

Table: 7.1
HOLDING SIZE DISTRIBUTION

i) All holdings and all crops

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	⟨------- % --------⟩ holdings	area	⟨-- cumulative % --⟩ holdings	area
0 - .25	16	0.1538	2.46	41	15	41	15
.25 - .5	13	0.3721	4.84	33	29	74	44
.5 - .75	4	0.6273	2.51	10	15	85	59
.75 - 1	2	0.8701	1.74	5	10	90	69
1 - 1.25	2	1.1080	2.22	5	13	95	82
1.25 - 1.5	1	1.4007	1.40	3	8	97	91
1.5 - 1.75	1	1.5417	1.54	3	9	100	100
1.75 - 2						100	100
2 - 2.5						100	100
2.5 - 3						100	100
3 - 5						100	100
5 - 10						100	100
10 - highest						100	100
Total	39	0.4284	16.71	100	100		

Mean	0.428	S.E. Mean	0.058
Median	0.304	Coef. of Var %	85
Std Dev	0.364	Variance	0.133
Kurtosis	2.099	S.E. Kurtosis	0.741
Skewness	1.595	S.E. Skewness	0.378
Range	1.470	Minimum	0.072
Maximum	1.542	Sum	16.706
Gini	0.403		

Note that the main table is a frequency distribution of grouped intervals, while the statistics at the foot of the table describe the ungrouped data set.

HOLDING SIZE DISTRIBUTION

all holdings - all crops

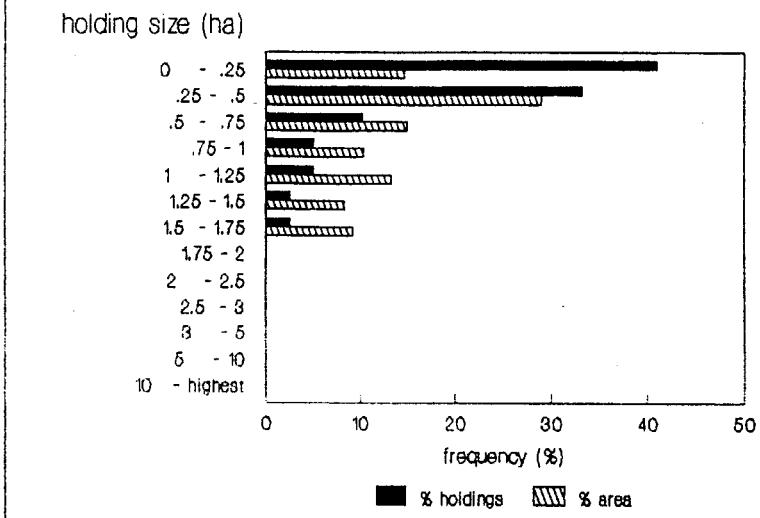


Diagram: 7.1

LORENZ CURVE

all holdings - all crops

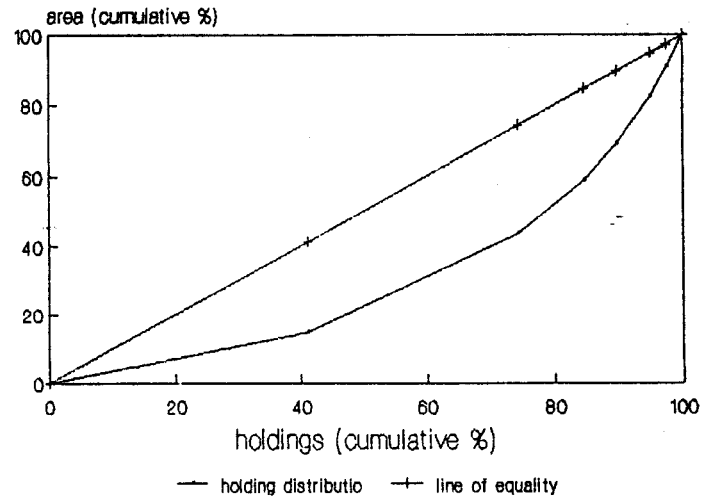


Diagram: 7.2

7.5 Table 8.1.ii shows the holding size distribution of only those farmers who have tree crops. The sample is reduced from 39 to 25, and so the stratum of farmers with tree crops represents **64%** of farmers in the sample. The mean holding size among tree cropping farmers of **.583ha** is slightly larger than the overall mean holding size, and the median is **.461ha.** Indicators of variability are again fairly low.

ii) Holdings with tree crops

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	(------- % --------) holdings	area	(-- cumulative % --) holdings	area
0 - .25	3	0.1924	0.58	12	4	12	4
.25 - .5	12	0.3815	4.58	48	31	60	35
.5 - .75	4	0.6273	2.51	16	17	76	53
.75 - 1	2	0.8701	1.74	8	12	84	65
1 - 1.25	2	1.1080	2.22	8	15	92	80
1.25 - 1.5	1	1.4007	1.40	4	10	96	89
1.5 - 1.75	1	1.5417	1.54	4	11	100	100
1.75 - 2						100	100
2 - 2.5						100	100
2.5 - 3						100	100
3 - 5						100	100
5 - 10						100	100
10 - highest						100	100
Total	25	0.5825	14.56	100	100		

Mean	0.583	S.E. Mean	0.075
Median	0.461	Coef. of Var %	64
Std Dev	0.374	Variance	0.140
Kurtosis	0.893	S.E. Kurtosis	0.902
Skewness	1.263	S.E. Skewness	0.464
Range	1.382	Minimum	0.159
Maximum	1.542	Sum	14.563
Gini	0.313		

7.7 The new distribution of farmers with tree crops is illustrated in diagram 7.3, and its associated Lorenz curve in diagram 7.4. Partitioning farmers in this way has reduced the variability of holding sizes and inequalities in the holding size distribution with a Gini coefficient of only 0.313.

HOLDING SIZE DISTRIBUTION

holdings with tree crops

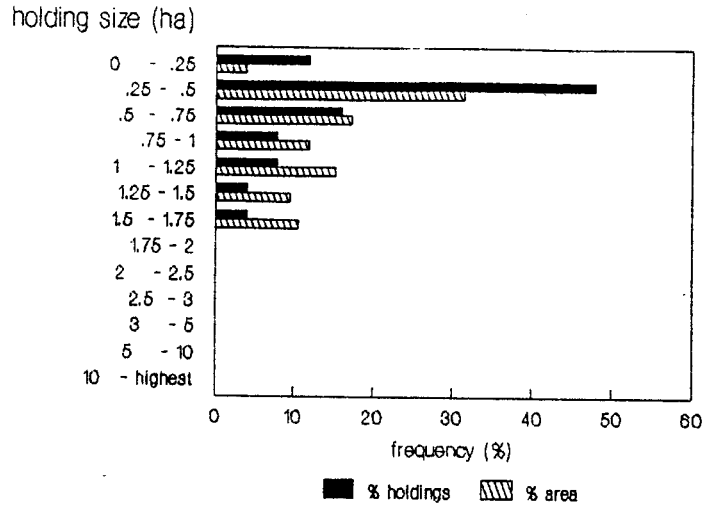


Diagram: 7.3

LORENZ CURVE

holdings with tree crops

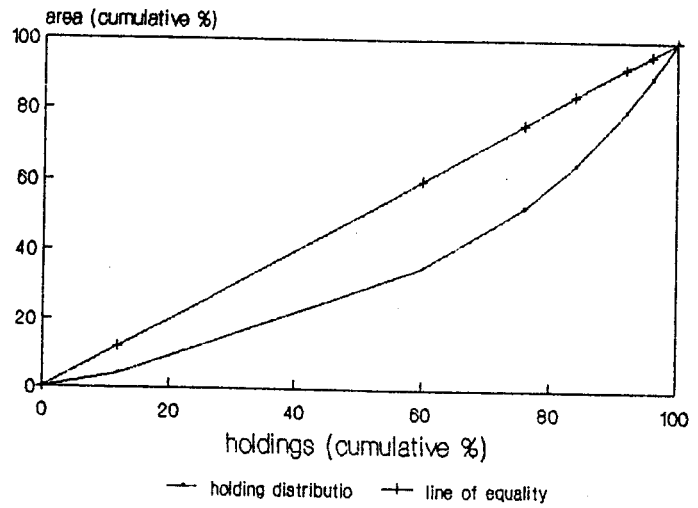


Diagram:7.4

7.8 The stratum of farmers with no tree crops is shown in table 7.1.iii and contains 14 farmers, or **36%** of sampled farmers. The mean holding size among farmers with no tree crops is **0.153ha** and the median is **0.143ha**. The range is small with a maximum holding size of only **0.260ha**.

7.9 The holding size distribution is illustrated in diagram 7.5, and its associated Lorenz curve in diagram 7.6. Inequality is very low with a Gini coefficient of **0.141**.

iii) Holdings without tree crops

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	% holdings	% area	cumulative % holdings	cumulative % area
0 - .1	2	0.0837	0.17	14	8	14	8
.1 - .2	9	0.1434	1.29	64	60	79	68
.2 - .3	3	0.2283	0.68	21	32	100	100
.3 - .4						100	100
.4 - .5						100	100
.5 - .6						100	100
.6 - .7						100	100
.7 - .8						100	100
.8 - .9						100	100
.9 - 1						100	100
1 - 1.5						100	100
1.5 - 2						100	100
2 - highest						100	100
Total	14	0.1531	2.14	100	100		

Mean	0.153	S.E. Mean	0.014
Median	0.143	Coef. of Var %	33
Std Dev	0.051	Variance	0.003
Kurtosis	-0.018	S.E. Kurtosis	1.154
Skewness	0.536	S.E. Skewness	0.597
Range	0.188	Minimum	0.072
Maximum	0.260	Sum	2.143
Gini	0.141		

Note the smaller size classes in this table with respect to previous tables.

HOLDING SIZE DISTRIBUTION

holdings without tree crops

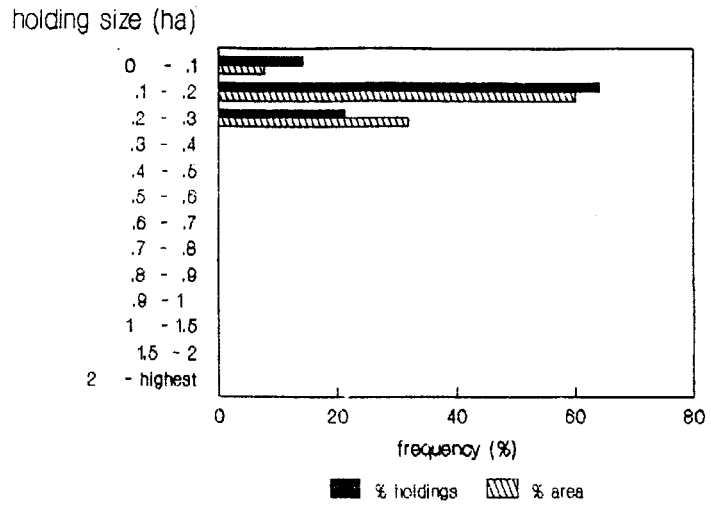


Diagram:: 7.5

LORENZ CURVE

holdings without tree crops

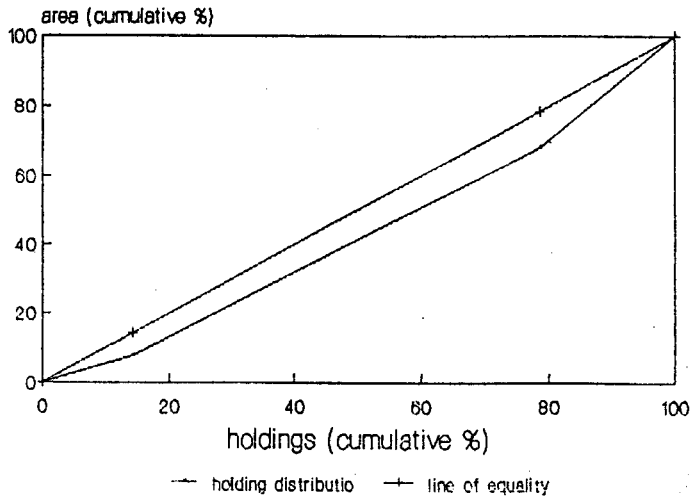


Diagram: 7.6

7.10 Holding sizes in Reef Islands are very small, with an overall mean size of **0.428ha**. **36%** of farmers have no tree crops and a mean size of only **0.153ha**. Of the **64%** of farmers that do have tree crops the mean holding size is still only **0.583ha**. The small scale of holdings is indicative of generations of fragmentation which has taken place under high population pressure. Most farmers are now on the margin of viability and are becoming increasingly dependant on other sources of livelihood such as fishing. Pressures will increase relentlessly, with farming systems coming under further stress in the future.

7.11 Any proposals to improve the livelihood of Reef Island farm families must take account of the small scale of operations and the very real constraints imposed by land shortages. Such proposals may include the allocation of land on other islands, the intensification of land use through more productive methods of agriculture, and the productive use of bush fallow in a sustainable way.

Chapter: 8
LABOUR DENSITY

8.1 According to Bathgate[18] "increments in the population of a household do not result in an expansion in the garden area. Instead, the garden area holds constant and ... the actual area per consumption and labour unit decreases ... Although there is a variation ... the average household ... tends to clear a fairly similar amount of land for gardens and plant a similar area of root crops". Bathgate postulates that there is no relationship between household size and food garden area. Larger family sizes are not then associated with larger holdings, and he attributes this to a tendency among subsistence producers to cultivate in excess of household requirements as insurance against crop failure. The situation is different in Reef Islands where land availability governs holding size, irrespective of other factors.

8.2 Table 8.1 shows the relationship between holding size and labour availability.

Table: 8.1
LABOUR DENSITY - ALL HOLDINGS

holding size class (ha)	units of labour	mean holding area (ha)	labour density (labour/ha)	number of observations
all holdings	4.48	0.43	10.46	39
< .25	4.34	0.15	28.24	16
.25 - .5	3.37	0.37	9.05	13
.5 - .75	6.15	0.63	9.80	4
.75 - 1	6.45	0.87	7.41	2
1 - 1.25	9.95	1.11	8.98	2
1.25 - 1.5	2.00	1.40	1.43	1
1.5 - 1.75	2.00	1.54	1.30	1
1.75 - 2				
2 - 2.5				
2.5 - 3				
3 - 5				
5 - 10				
> 10				

8.3 All holdings are small and labour availability is not limiting. While labour availability increases up to a holding size of 1.25ha, the two larger holdings have low levels of available labour. Labour density falls rapidly from 28.24 adult units per hectare for the smallest holding class (less than 0.25ha) to 1.30 units in the largest (1.5 - 1.75ha) class. All holdings then have a high labour density, except in the case of the two larger holdings.

8.4 With a mean labour density of 10.46 labour units per hectare there is considerable pressure on available land. Labour density is illustrated in diagram 8.1.

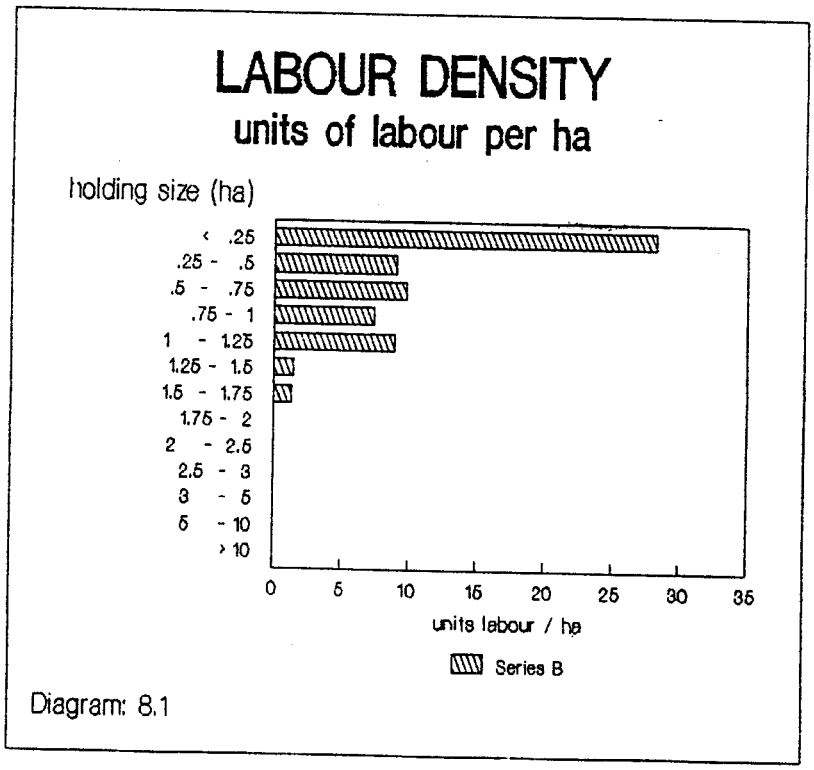


Diagram: 8.1

8.5 Holdings without tree crops have an even higher mean labour density of 28.41 labour units per hectare, while holdings with tree crops have a slightly lower mean density of 7.81 labour units per hectare. Results are summarised in tables 8.2 and 8.3.

Table: 8.2
LABOUR DENSITY - NON-TREE CROP HOLDINGS

holding size class (ha)	units of labour	mean holding area (ha)	labour density (labour/ha)	number of observations
all holdings	4.35	0.15	28.41	14
< .25	4.48	0.14	30.95	13
.25 - .5	2.60	0.26	10.02	1
.5 - .75				
.75 - 1				

Table: 8.3
LABOUR DENSITY - TREE CROP HOLDINGS

holding size class (ha)	units of labour	mean holding area (ha)	labour density (labour/ha)	number of observations
all holdings	4.55	0.58	7.81	25
< .25	3.73	0.19	19.40	3
.25 - .5	3.43	0.38	9.00	12
.5 - .75	6.15	0.63	9.80	4
.75 - 1	6.45	0.87	7.41	2
1 - 1.25	9.95	1.11	8.98	2
1.25 - 1.5	2.00	1.40	1.43	1
1.5 - 1.75	2.00	1.54	1.30	1
1.75 - 2				

8.6 Land availability is constrained. Holdings are small and are under considerable stress. Without intensification a high proportion of holdings are unviable, and without conservation the soils of Reef Islands are liable to degrade rapidly under present and future pressures on agriculture.

Chapter: 9
CROPPING PATTERNS

9.1 A "holding" is taken here to be the total area cultivated by a household. It includes all crops growing and land cleared, but does not include fallow which the family may have rights to cultivate.

9.2 A holding is divided into one or more "gardens", which are contiguous blocks of land growing similar crops. Only broad distinctions are made among crop types in gardens.

9.3 A garden may be subdivided into "plots" which are blocks within each garden growing a different crop mix, under different management, or planted at different times. Within plots detailed crop mixtures are recorded.

9.4 Table 9.1 describes cropping patterns at the garden level, maintaining the distinction between farmers who grow tree crops and those who do not.

9.5 Tree crop farmers have a mean holding size of **0.58ha**, of which **0.44ha** is tree crops and **0.14ha** food crops. In contrast, non-tree crop farmers have a mean holding size of **0.15ha**.

9.6 Tree cropping farmers tend to have more complex holdings, with an average of **3.12** gardens and **4.48** plots compared with **2.29** gardens and **2.86** plots among non-tree crop farmers.

9.7 Table 9.2 describes cropping patterns in more detail. This is derived from the aggregation of plot information in which complex mixtures are summarised by the dominant crop. **12** major crop mixture classes are listed in table 9.2, covering a wide range of crops.

Table: 9.1
CROP COMPOSITION

i) All holdings

crop category	mean area in holding (ha)	mean no gardens per holding	mean no plots per holding	mean no plots per garden	summary of crop area
cleared land					
tree crops	0.28	0.87	0.97	1.11	++
short term cash crops					
food crops	0.15	1.95	2.92	1.50	+
total	0.43	2.82	3.89	1.38	

number of observations = 39

ii) Holdings with tree crops

crop category	mean area in holding (ha)	mean no gardens per holding	mean no plots per holding	mean no plots per garden	summary of crop area
cleared land					
tree crops	0.44	1.36	1.52	1.12	++++
short term cash crops					
food crops	0.14	1.76	2.96	1.68	+
total	0.58	3.12	4.48	1.44	

number of observations = 25

iii) Holdings without tree crops

crop category	mean area in holding (ha)	mean no gardens per holding	mean no plots per holding	mean no plots per garden	summary of crop area
cleared land					
tree crops					
short term cash crops					
food crops	0.15	2.29	2.86	1.25	+
total	0.15	2.29	2.86	1.25	

number of observations = 14

Table: 9.2
CROPPING PATTERNS

	main crop in mixture	all farmers		farmers with no tree crops		farmers with tree crops	
		area (ha)	%	area (ha)	%	area (ha)	%
a	Cleared Land	0.005	1	0.004	2	0.006	1
b	Coconut	0.244	57			0.396	67
c	Cocoa						
d	Pasture						
e	Grain Crops						
f	Beans						
g	Cabbage	0.002	0			0.003	0
h	Vegetables						
i	Spices						
j	Fruit Crops						
k	Fruit trees	0.004	1			0.006	1
l	Banana	0.001	0	0.003	2		
m	Citrus trees						
n	Nut trees	0.021	5	0.003	2	0.031	5
o	Sugar cane	0.000	0			0.000	0
p	Food/building tree	0.010	2	0.016	10	0.006	1
q	Tobacco	0.000	0			0.000	0
r	Sweet Potato	0.098	23	0.097	59	0.099	17
s	Taro						
t	Yam	0.001	0			0.002	0
u	Pana	0.040	9	0.035	21	0.043	7
v	Cassava	0.003	1	0.007	4	0.000	0
w	Other root crop						
	Total mean area (ha)	0.429		0.165		0.592	
	Number of households	39		15		24	

9.8 The spatial dominance of coconut cropping on farming systems is seen clearly in diagrams 9.1 to 9.3. Coconuts account for **57%** of the total area but are grown by only **62%** of farmers, suggesting that there are two major types of farmer in the survey area. The gardens under annual crops among tree cropping farmers tend to be more diverse in terms of main crop type (table 9.2), and more complex (table 9.1) than those among non-tree crop farmers.

9.9 Table 9.2 is a simplification of cropping patterns found in the field. Table 9.3 describes in more detail the crop mixtures grown by farmers. This no longer applies to a "model" holding, but detailed cropping patterns may be used to determine proportional areas under crop mixtures.

9.10 Mixtures are listed hierarchically to the left of the table according to the relative dominance of each crop in the mixture. The three main crops in any mixture are listed by name and any further crops are referred to by code letters. The column of "mean plot area" records the mean area of plots measured in the field according to the number of observations shown in the next column to the right. The column on the far right is the proportional area by crop mixture.

9.11 Crop mixtures illustrate the complexity of smallholder farming systems, in which **65** distinct mixtures are recorded, and also describes distinctive features of Reef Islands agriculture. Tree crop mixtures are not only complex but tree crops and food crops are commonly grown in mixed stands. Under growing population pressure, mixed stands of this kind are being lost to annual cropping, particularly of sweet potato. Fragile atoll soils become impoverished of organic matter and nutrients under intensive annual cropping and lose their moisture retention capacity. Fallow regrowth is poor, and bare soil exposed to the direct sun becomes progressively barren. Such areas are said to be "dry", meaning infertile but also describing the physical dryness compared with cool, moist soils under trees.

9.12 Soil exhaustion and the loss of mixed tree/food gardens has prompted a proposal for the revival of Temotu traditional agriculture in the Reef Islands[31] which aims at food garden diversity and productivity, sustainability through protection of the soil, and the reclamation of dry areas. The sustainable use of land will depend to a large extent on measures to protect soils. In atoll agriculture this requires preservation of the humus mat under trees, and the future of Reef Islands agriculture seems to lie in this direction.

CROPPING PATTERNS

all farmers

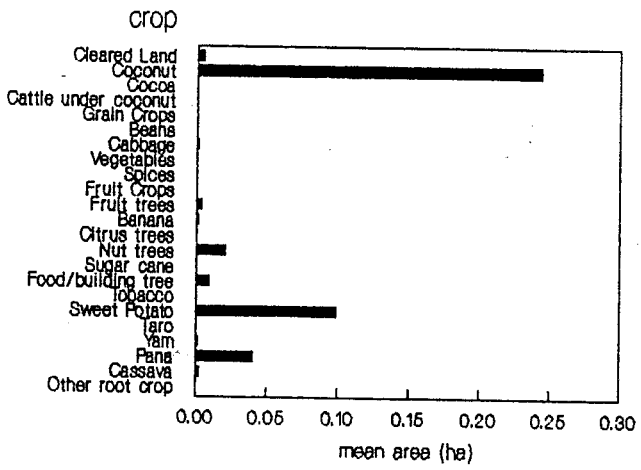


Diagram: 9.1

CROPPING PATTERNS
farmers with no tree crops

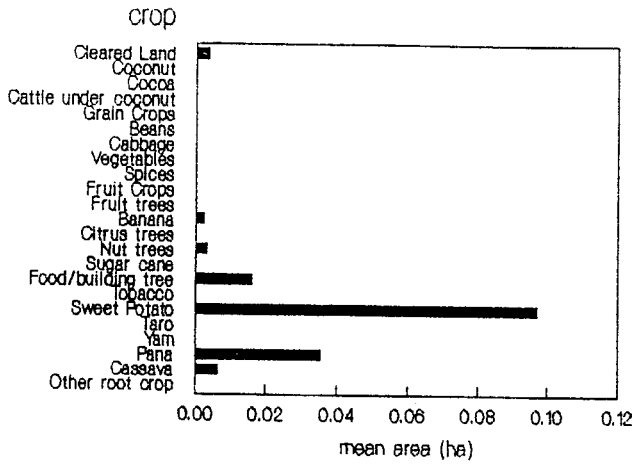


Diagram:9.2

CROPPING PATTERNS
farmers with tree crops

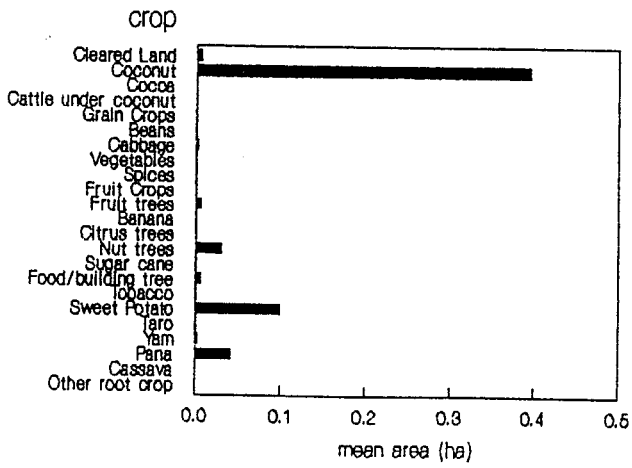


Diagram:9.3

Table: 9.3
DETAILED CROPPING PATTERNS

crop code	main crop in mixture — crop name: first	second	third	minor mixture code	mean plot area (ha)	number of plots	% plots	% area
TOTAL					0.0552	152	100	100
a	Cleared land				0.0676	3	2	1.213
b	Coconut				0.2842	12	8	20.41
		Fruit trees	Food/build tree	j	0.3677	1	1	2.201
		Banana			0.0737	1	1	0.441
			Fruit trees		0.4034	2	1	4.828
		Nut trees	Fruit trees		0.9000	1	1	5.387
			Food/build tree		0.3526	4	3	8.443
				lk	0.4219	1	1	2.525
		Food/build tree			0.1276	2	1	1.527
			Fruit crops		0.1128	1	1	0.675
				k	0.1105	1	1	0.661
			Nut trees		0.3863	3	2	6.937
		Cassava	Banana	nm	0.4800	1	1	2.873
g	Cabbage	Nut trees	Food/build tree		0.0556	1	1	0.332
k	Fruit trees	Nut trees	Food/build tree	l	0.1423	1	1	0.851
l	Banana	Sugar cane	Fruit crops	v	0.0426	1	1	0.255
n	Nut trees				0.0224	1	1	0.134
		Food/build tree	Fruit trees	l	0.7200	1	1	4.309
				r	0.0546	1	1	0.326
o	Sugar cane				0.0074	1	1	0.044
p	Food/build tree	Coconut	Nut trees	k	0.2420	1	1	1.448
		Nut trees			0.0357	1	1	0.213
			Fruit trees		0.1122	1	1	0.671
q	Tobacco				0.0063	1	1	0.037
r	Sweet potato				0.0504	14	9	4.224
		Coconut			0.0434	1	1	0.259
		Grain crops	Fruit crops		0.1680	1	1	1.005
		Cabbage			0.0701	1	1	0.419
			Fruit crops		0.0304	1	1	0.181
				k	0.0392	1	1	0.234
			Fruit trees	jv	0.0252	1	1	0.150
			Banana		0.0676	1	1	0.404
			Sugar cane		0.0307	1	1	0.183
				v	0.0412	1	1	0.246
		Fruit crops			0.0301	2	1	0.360
			Beans	vg	0.0814	1	1	0.487
			Cabbage		0.0487	1	1	0.291
			Banana		0.0378	1	1	0.226
				vo	0.0321	1	1	0.192
			Food/build tree		0.0272	1	1	0.162
			Cassava	g	0.0874	1	1	0.523
		Banana			0.0890	3	2	1.598
			Sugar cane		0.0411	1	1	0.246
			Cassava		0.0960	3	2	1.723

crop code	main crop in mixture — crop name: first	second	third	minor mixture code	mean plot area (ha)	number of plots	% plots	% area
		Nut trees	Fruit crops		0.1842	1	1	1.102
		Sugar cane	Cabbage	v	0.0362	1	1	0.216
			Fruit crops	g	0.0748	1	1	0.447
			Banana		0.0261	1	1	0.156
		Food/build tree			0.0419	2	1	0.501
			Fruit crops		0.0783	1	1	0.468
				ln	0.0225	1	1	0.134
			Nut trees	g	0.0706	1	1	0.422
			Cassava	g	0.0759	1	1	0.454
				l	0.0809	1	1	0.484
		Taro	Banana	g	0.0559	1	1	0.334
			Sugar cane		0.0633	1	1	0.378
		Pana			0.0146	1	1	0.087
			Cassava	n	0.0740	1	1	0.442
		Cassava			0.0366	10	7	2.192
			Cabbage	j	0.0445	1	1	0.266
			Fruit crops		0.0590	2	1	0.706
			Sugar cane		0.0491	1	1	0.293
				l	0.0764	1	1	0.457
			Pana	j	0.0536	1	1	0.320
t	Yam	Fruit trees			0.0397	1	1	0.237
u	Pana				0.0443	24	16	6.358
		Cabbage			0.0285	2	1	0.341
		Fruit crops	Cabbage		0.0940	1	1	0.562
		Banana			0.0326	2	1	0.390
		Tobacco			0.0160	1	1	0.095
		Sweet potato			0.0385	1	1	0.230
		Cassava			0.0441	4	3	1.055
			Cabbage		0.0480	1	1	0.287
v	Cassava	Cabbage	Coconut	l	0.1045	1	1	0.625
		Sweet potato	Cabbage		0.0116	1	1	0.069

Crop Key:

a Cleared land	j Fruit crops	r Sweet potato
b Coconut	k Fruit trees	s Taro
c Cocoa	l Banana	t Yam
d Pasture	m Citrus trees	u Pana
f Beans	n Nut trees	v Cassava
f Beans	o Sugar cane	w Other root crop
g Cabbage	p Food/building tree	
h Vegetable	q Tobacco	
i Spices		

9.13 Table 9.4 summarises tree cropping. The table is in two parts, first showing the average number of trees and second the number of observations on which they are based. Each table is subdivided horizontally into cultivated garden and fallow, and vertically by garden type. The averages in the top table are based on all plots (not only the plots in which trees are grown). In the far right column of the lower table is listed the number of observations for which trees are too numerous to count. These are excluded from the averages in the upper table.

9.14 Mixed stands of tree crops are common both in coconut gardens and in food gardens. A high proportion of cases, especially in fallow areas, have many (but an unknown number of) trees.

Table: 9.4
TREE CROPS IN GARDENS

<---------- average number of trees per garden ---------->

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) In cultivated gardens:					
fruit trees		3.62		2.49	2.78
citrus		0.61		0.16	0.29
nut trees		5.76		1.40	2.44
sweet banana		0.88		2.45	2.05
cooking banana		2.67		0.97	1.43
ii) In fallow of gardens:					
fruit trees					
citrus					
nut trees				0.36	0.24
sweet banana		0.32			0.11
cooking banana					

<---------- number of observations ---------->

crop type:	cleared land	tree crops	short term cash crops	food crops	many but "unknown"
i) In cultivated gardens:					
fruit trees		21		61	28
citrus		31		76	3
nut trees		21		67	22
sweet banana		25		73	12
cooking banana		27		73	10
ii) In fallow of gardens:					
fruit trees		6		10	94
citrus		19		44	47
nut trees		6		11	93
sweet banana		25		48	37
cooking banana		19		45	46

Chapter: 10
COCONUT

10.1 Coconut has been studied in some detail before, both in the 1974-75 Sample Survey of Agriculture[5] and in the 1985 Coconut Survey[6]. Coconuts are an important crop in the Reef Islands and copra is a commodity of major economic importance providing income to **36%** of households (table 4.2). Comparative data on coconuts are included in the present study.

10.2 Copra exports from Solomon Islands started in the late 19th century, rising from **1,220 MT** in 1895 to **23,000 MT** in the '20s and '30s. Following disruption during the second world war production did not achieve pre-war levels again until the 1960s. Copra production has continued to rise since, exceeding **40,000 MT** in 1984 and 1985. Following cyclone Namu copra production fell by about 20 to 25%, but showed some recovery in 1987/88.

10.3 The structure of the copra economy has varied considerably since the start of trading. Initially a smallholder crop, the plantation sector came to dominate production from 1915 onwards. Since the 1970s smallholder production has been growing by about **4.5%** annually and smallholder copra production now accounts for around **70%** of the total[8].

10.4 The area under smallholder coconuts has expanded considerably over the past 15 years, in part due to a subsidy scheme operating from 1968 to 1978 which was designed to encourage the rehabilitation, planting and replanting of coconut palms. Consequently the age structure of smallholder palms is young, with almost half the palms planted since 1970 and nearly **90%** planted since the war[8].

10.5 The total number of coconut palms in Solomon Islands is estimated to be around **9 million**, covering an area of approximately **60,000 hectares**. Table 10.1 shows the provincial breakdown of copra production, in which Western, Guadalcanal, Malaita and Central Provinces account for about **80%** of production.

10.6 The mean national copra yield is **0.72** MT per hectare according to the 1985 Coconut Survey[7]. The 1974-75 Sample Survey of Agriculture found that the average number of coconuts per palm was **36** (30 in the 1985 Coconut Survey) and assumes an average whole nut weight of **1.2kgs** with **190gm** dried copra equivalent per nut. Disciplined plantings were found to yield **40%** more per tree than customary plantings, but only **7%** more per unit

area because of the greater density of customary planted trees. This result was was questioned in the 1985 Survey.

Table: 10.1
COPRA AREA AND PRODUCTION BY PROVINCE (1984)

Province	(-- area --)		(-- production --)		yield	number of palms
	(ha)	%	(MT)	%	(MT/ha)	
Western	14,454	25	13,816	32	0.96	2,093,795
Ysabel	5,230	9	2,969	7	0.57	817,555
Central	7,909	13	9,073	21	1.15	1,287,680
Guadalcanal	12,758	22	7,324	17	0.57	1,824,790
Malaita	11,890	20	5,575	13	0.47	1,980,595
Makira	3,555	6	2,662	6	0.75	540,810
Temotu	3,032	5	1,167	3	0.38	494,420
Total	58,918	100	42,586	100	0.72	9,039,645

Source: Statistics Office, Solomon Islands (1986), Statistical Bulletin 18/86

10.7 The yield from well maintained plantations was found to be higher than from poorly maintained plantations, but the 1985 Coconut Survey attributed this to more intensive harvesting rather than the productivity of palms (5).

10.8 In the 1985 Coconut Survey soil type was classified into three broad categories. **41%** of plots lay on sand or coral; **47%** on black alluvial soils; and **21%** on red clay. It was concluded that the reason for low yields is often area specific but soil nutrient deficiency, notably potassium, is an important factor. Despite this, and high copra prices at the time, the 1974-75 survey found that "fertilizer is only applied when provided under some sort of subsidy scheme" and that "smallholder farmers will not buy fertilizer to use on their own plots. There is generally a lack of understanding of the use of fertilizer by farmers, and in many cases a reluctance to use it even when it is provided at a subsidised price" (5).

10.9 Other important factors identified in the 1985 Coconut Survey as affecting production were pests and disease. Over half the plots sampled in the 1985 suffered from Leaf Spot, which may refer to the symptoms of pest infestation or nutrient deficiency. One quarter of plots showed some evidence of White Thread, but it was felt that neither problem significantly affected output. About 40 ot 50 percent of plots were felt to be disease free (7).

10.10 Amblypelta cocophaga appeared to be a significant pest in parts of Western province, the Floridas, Guadalcanal and Malaita. 38% of households reported premature nutfall which is linked to Amblypelta in certain localities. Brontispa spp was also evident, and minor pests included rhinoceros beetle (Scapanes australis), rats, cockatoos, flying foxes and others (7).

10.11 Table 10.2 presents additional results from the present study. Coconuts are 73% pure stand and 27% intercropped with food or other tree crops.

Table: 10.2
COCONUTS AND COCOA

	% plots		
	coconut	cocoa	coconut + cocoa
i) Intercropping:			
Pure stand	73		
Intercropping with:			
Coconut + cocoa			
Short term cash crops			
Food or other tree crops	27		
Livestock			
Total %	100		
Number of observations (plots)	33		
ii) Maintenance:			
Undercropped	6		
Brushed to ground level	18		
Brushed to shoulder height	42		
Secondary bush/tree crops	33		
Burnt			
Total %	100		
Number of plots	33		
iii) Coconut variety composition			
Tall	96		
Rennel	1		
Dwarf			
Other	3		
Total %	100		
Number of plots	33		

iv) Coconut age composition

< 8 years	6
9 - 16 years	1
17 - 40 years	90
> 40 years	1
senescent	3
Total %	100
Number of plots	33

10.14 Maintenance levels are illustrated in diagram 10.1. **33%** of coconut plots are described as having a ground cover of secondary bush, but in this case it mainly means that coconuts are grown in mixture with other trees.

10.15 Coconut varieties are almost entirely local tall and in mature stands. **7%** are less than 16 years of age, **90%** are in the age band 17-40 years, and **3%** are senescent.

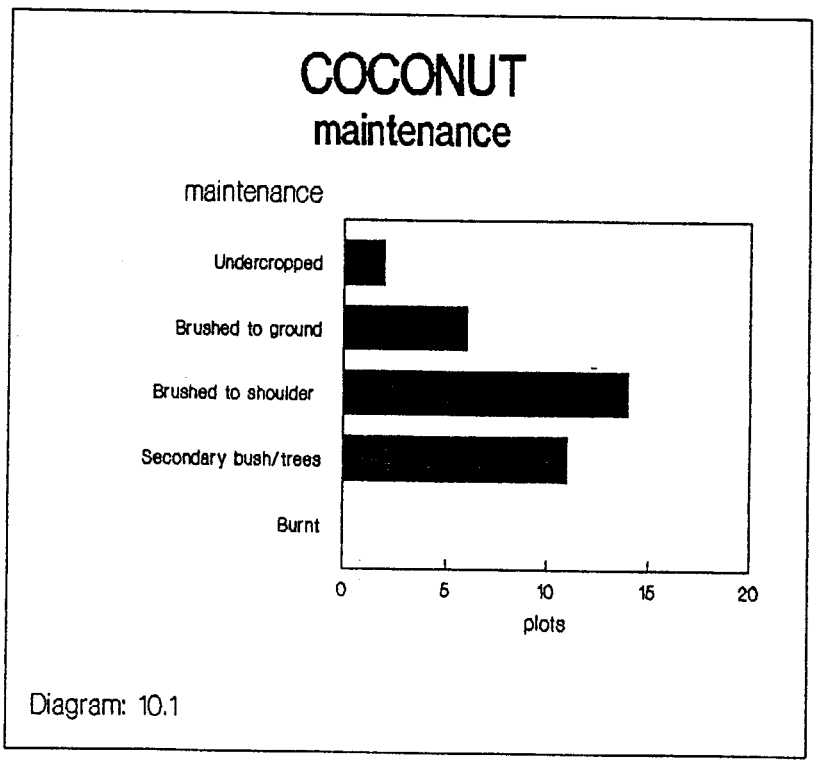


Diagram: 10.1

Chapter: 11
SOIL FERTILITY AND FALLOW

11.1 Throughout Solomon Islands almost all gardens are cultivated according to a form of shifting cultivation with bush fallow. In the 1974-75 Sample Survey of Agriculture it was found that, where population density or land tenure problems have restricted the availability of suitable land, the length of fallow may be reduced from the optimum 7 to 20 years to as little as one or two years. In such areas soil fertility becomes depleted through over frequent cropping[5].

11.2 Research in Solomon Islands has shown that soils are low to very low in potassium. The geology of the country is composed in the main of rocks which are low in potassium minerals, and potassium is readily leached from soil under conditions of continuously high rainfall and rugged topography. Fallow is essential for the restoration of potassium fertility: "Under traditional shifting cultivation the depletion of potassium by crops is gradually reversed over a period of 3-15 years or more by a combination of mineral weathering and root systems incorporating potash in the nutrient cycle". Although burning leads to an erratic distribution of potassium in the topsoil, "the burning of vegetative trash is beneficial and it has been shown that topsoil potassium is increased by as much as 100% on average after burning, all of this increase being held by the exchange complex"[9]. A problem encountered with atoll soils is that the nutrient is rapidly leached, and the organic reservoir in which it and other nutrients are stored is destroyed. Burning is likely to have severely detrimental effects on the soils of Reef Islands, resulting in heavy losses to both nutrients and the moisture retention capacity of the soil.

11.3 Phosphorus varies widely in its total and available forms, but Solomon Islands soils generally have low levels in the subsoil and medium levels of total phosphorus in the topsoil. In the high pH conditions of atoll soils phosphorus is precipitated and becomes unavailable to plants. Soil total nitrogen levels are generally adequate, with C:N ratios in the range 7-13 signifying the ready availability of nitrogen. Topsoil nitrogen is dependent on land use and in particular the length of fallow since there is a build-up of topsoil nitrogen under secondary regrowth. Sulphur is similarly associated with organic matter, and is higher under forest than under burned grassland[9]. The availability of these nutrients in atoll soils is similarly determined by organic matter content.

11.4 Atoll soils have characteristics which set them apart from the soils of the main islands. Characteristically atolls have limited land area and few natural resources where specialised plant communities are adapted to saline, alkaline soils which are subject to water stress and salt spray[32,34]. Reef Islands agriculture is typical of such conditions, with agriculture based around coconuts, pandanus and breadfruit. The Reef Islands are for the most part well drained and the main root crop traditionally is yam rather than taro of other atoll systems.

14.5 Atoll soils, derived from calcareous parent material tend to be shallow, alkaline and coarse textured. Their fertility is dependent on their organic matter content which may be high in undisturbed soils but decreases dramatically when land is opened up, and particularly when cleared by fire. Organic matter plays an important role in the concentration and cycling of nutrients and governs moisture retention in excessively well drained atoll soils[32,35].

14.6 Potassium levels are frequently extremely low and the alkaline pH makes several trace elements - particularly iron, manganese and zinc, but also copper and boron - unavailable to plants. Phosphates form insoluble complexes with iron and so P may also be deficient[32,33].

14.7 High soil pH and $CaCo_3$ levels not only reduce the availability of nutrients in the soil but precipitate nutrients when applied in chemical fertilisers. High application rates are therefore necessary to provide sufficient micronutrients in a plant available form. Organic matter is capable of holding nutrients in forms available to plants and therefore the maintenance of soil organic matter increases fertiliser use efficiency[33].

14.8 Various forms of fertiliser application are possible, including the use of foliar sprays or chelated organic forms to reduce nutrient precipitation in the soil, but Caiger(1987) states that the application of straight inorganic chemical fertilisers before cropping is the simplest and therefore the most appropriate method[33]. Alternatively, macro- and micro-nutrients may be added to compost. Nutrients are then absorbed by microorganisms and converted to slow release organic forms, while the high cation exchange capacity of the organic matter reduces leaching losses[35]. In some circumstances burying a large number of flattened iron cans in the planting hole of perennial crops has proved beneficial[35].

14.9 It is clear that such processes are taking place in Reef Islands. The growing dependance on annual crops due to increasing land pressure is accelerating the clearance of tree crops and bush fallow. Soils under tree crops are characteristically cool and moist, with a deep leafy litter which supports a diverse range of plants growing in close association. During land clearance for annual cropping the trash is commonly burnt. Good yields are obtained, but only briefly, in the resultant nutrient flush. Yields decline rapidly as nutrients are leached or precipitated. The moisture retention capacity of the soil is reduced and the destruction of organic matter is seen in the impoverishment of soils. The locally used term that soils go "dry" is appropriate, also implying barren in terms of poor fertility. Such soils when cropped too frequently become bare, supporting poor regrowth, and shallow.

11.10 An analysis of fallow tells much about the dynamics of smallholder agriculture and pressures on farming systems in Reef Islands.

11.11 In the 1974-75 Sample Survey of Agriculture[5] it was stated that, while in overall terms Solomon Islands cannot be said to be suffering from land pressure, it may occur in some areas. Table 11.1 shows the distribution of garden land by the length of the bush fallow in 1975.

Table: 11.1
LENGTH OF BUSH FALLOW (1975)

length of bush fallow (years)	Western	Ysabel Central Guadalcanal	Malaita	Makira Temotu	Solomon Islands
	% observations				
< 2	23	6	17	16	14
2 - 4	20	5	33	14	18
5 - 7	4	11	25	12	15
8 - 10	10	10	8	15	10
> 10	13	20	3	14	13
never previously cultivated	29	48	15	29	32
Mean length fallow (years)	5.6	9.2	4.5	6.7	6.4

Source: Statistics Office (1978), 1974-75 Agricultural Statistics Survey

11.12 Table 11.2, also from the 1974-75 survey, shows the distribution of garden land by length of cultivation.

Table: 11.2
LENGTH OF CULTIVATION (1975)

length of cultivation (months)	Western	Ysabel Central Guadalcanal	Malaita	Makira Temotu	Solomon Islands
	% observations				
< 4	20	45	11	19	27
4 - 6	62	31	36	22	37
7 - 9	12	13	25	33	19
10 - 12	5	8	14	18	10
> 12	2	4	14	8	7
Mean cultivation (months)	5.1	4.7	7.6	7.2	6.0

Source: Statistics Office (1978), 1974-75 Agricultural Statistics Survey

11.13 In 1975 it was found that 32% of gardens in Solomon islands had never been previously cultivated, and that the average length of bush fallow of cultivated gardens was 6.4 years. Only 7% of gardens were generally cultivated for more than 12 months before reverting to fallow, and the average length of cultivation of food gardens was 6 months.

11.14 Table 11.3 summarises cropping intensity in the survey area. The crop period is shown in the first column, which is the time from planting to harvest for the named crop. The second column describes the number of times an area is cropped in sequence before reverting to fallow. This introduces complexity since the crop type may, and commonly does, change within the sequence. Thus yam will commonly be followed by sweet potato. There are additional complications in that a high proportion of crops are grown in association with tree crops in which the term fallow has little meaning. The important entries in the table are for the annual root crops.

Table: 11.3
CROPPING INTENSITY

crop type		harvest to harvest (months)	number of crops in sequence	number of cases (obs)
all crops		5.0	1.9	172
cleared land	a		2.3	3
coconut	b	6.0	1.3	31
cabbage	g	5.0	3.0	1
fruit crops	j	6.0	2.0	1
fruit trees	k	7.5	1.6	5
banana	l		3.0	2
nut trees	n	6.0	1.9	11
sugar cane	o		3.0	1
food/building tree	p	4.5	2.0	6
tobacco	q	2.0	1.0	1
sweet potato	r	3.7	2.1	71
yam	t	5.0	2.0	1
pana	u	6.9	2.0	36
cassava	v	6.0	3.5	2

Note: Cases where harvest is "a very long time" or where crops are not harvested are excluded (= 33 cases, mainly coconuts)

11.15 Generally annual crops, of which the two dominant crops are sweet potato and pana, are cropped twice before land is abandoned to fallow. Commonly pana will be planted in sequence first, with a seven month growing period, and will be followed by sweet potato with a four month growing period.

11.16 Table 11.4 describes the fallow period, however, this has little meaning for tree crops since the interpretation of fallow varies with the age of the tree crop and previous cropping history. For food crops the fallow period relies on the knowledge of the respondent. Often it is found that long fallow periods are beyond the memory of operators and these are referred to as "cases longer than memory". **48%** of gardens have such long fallows. Where the fallow period is known on food gardens there are 5.9 years of fallow between cropping.

11.17 Fallow periods cover a range of soil and site conditions. Table 11.5 shows that **28%** of food gardens have fallow periods longer than memory and account for **34%** of the food crop area, but this arises from the clearing of tree gardens prior to annual cropping.

Table: 11.4
FALLOW PERIOD (years)
years

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
mean years of fallow		11.5		5.9	6.1
standard deviation (years)		12.0		6.8	6.9
number of cases (gardens)		2		55	57
cases longer than memory					53
total cases (gardens)					110

Table: 11.5
FALLOW RANGE
i) Fallow Range by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no fallow					
1 year				5	5
2 years				8	8
3 years		1		15	16
4 years				6	6
5 years				8	8
6 - 10 years				6	6
11 - 20 years		1		4	5
21 - 50 years				3	3
beyond memory ("long time")		32		21	53
total by crop type		34		76	110

ii) Fallow Range by % area of holding

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no fallow					
1 year					
2 years				6	6
3 years				6	6
4 years				6	6
5 years				6	6
6 - 10 years					
11 - 20 years					
21 - 50 years					
beyond memory ("long time")		65		12	76
total by crop type		65		35	100

Note: The table of % area is only approximate due to rounding small numbers

11.18 The type of fallow in Reef Islands is shown in table 11.6. There is no primary forest and only **18%** of food gardens have fallow described as "secondary forest" which extends to **17%** of the food garden area, but most fallow is dense shrubby thicket extending over **59%** of food gardens and **51%** of the food garden area. **21%** of food gardens are cleared from former tree crop land, extending over **34%** of the food garden area.

Table: 11.6
FALLOW TYPE

i) Fallow type by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
primary forest		9			9
secondary forest		10		14	24
dense thicket				45	45
open scrub grassland				1	1
grassland					
plantation tree crops		15		16	31
other fallow					
total by crop type		34		76	110

ii) Fallow type by % area of holding

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
primary forest		18			18
secondary forest		24		6	29
dense thicket				18	18
open scrub grassland					
grassland					
planted fallow		24		12	35
other fallow					
total by crop type		65		35	100

Note: The table of % area is only approximate due to rounding small numbers

11.19 These results show that there is a rapid loss of productive tree crops due to increasing dependance on annual cropping as a result of land pressure. Soils are rapidly degrading and the Reef Islanders themselves believe that at current rates of destruction there will be little land left suitable for cropping beyond the next ten years.

Chapter: 12
LANDFORM

12.1 An atoll has been described as "a living reef which is separated from the nearest land of volcanic origin by water having a depth greater than that at which hermatypic (reef-building) corals can grow", which is a depth taken to be 80m [36]. The Reef Islands are believed to be resting on a volcanic foundation [10].

12.2 Soil development in Solomon Islands is primarily a function of landscape stability rather than age of parent material. Platforms underlain by limestones permit soil weathering to continue without soil depletion by surface wash. Whereas soils of volcanic origin on slopes are continually rejuvinated by soil wash, the soils of Reef Islands are subject to intense weathering and leaching in situ and thus become quickly depleted of nutrients. The top, organic-rich layers are believed to be of volcanic origin, through the addition of ash from Tinakula in recent geological time, overlying weathered carbonate sands [10].

12.3 Table 12.1 shows the distribution of cultivated land according to landform. The first part of the table records the number of observations (gardens) and is expressed in area terms in the second part of the table. The Reef Islands have a low relief with slopes recorded on all gardens of less than 5 degrees. No methods of soil conservation or alley cropping are practiced. 37% of the coconut area is on beach sites and 63% is on the inland coraline platform. 17% of the food gardens area is on beach sites and 83% is on the inland platform. Landform is illustrated in diagram 12.1.

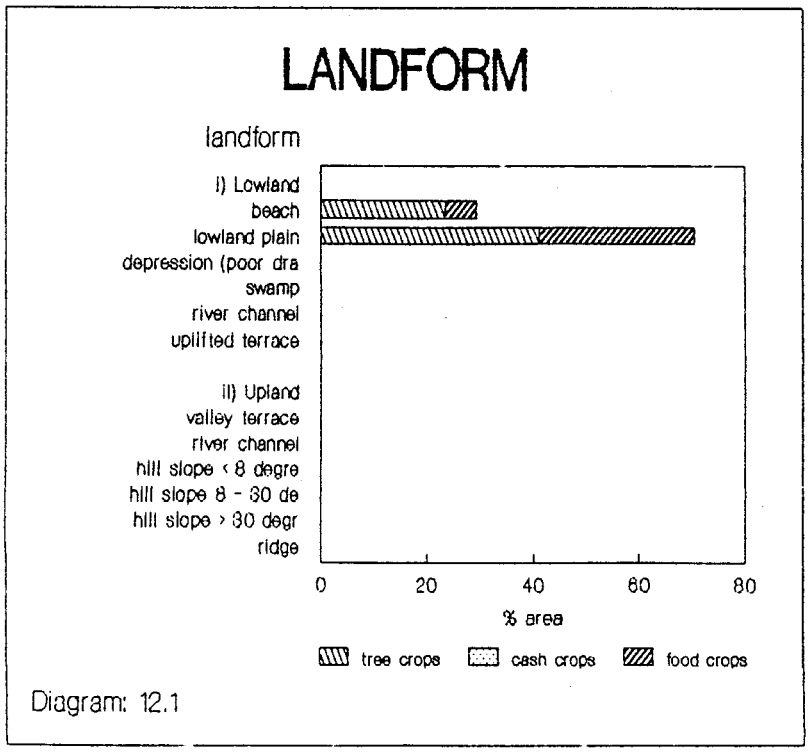


Diagram: 12.1

Table: 12.1

LANDFORM

i) Landform by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
beach		7		5	12
lowland platform		27		67	94
depression (poor drainage)					
swamp					
river channel					
uplifted terrace				4	4
total by crop type		34		76	110

ii) Landform by % area of holding

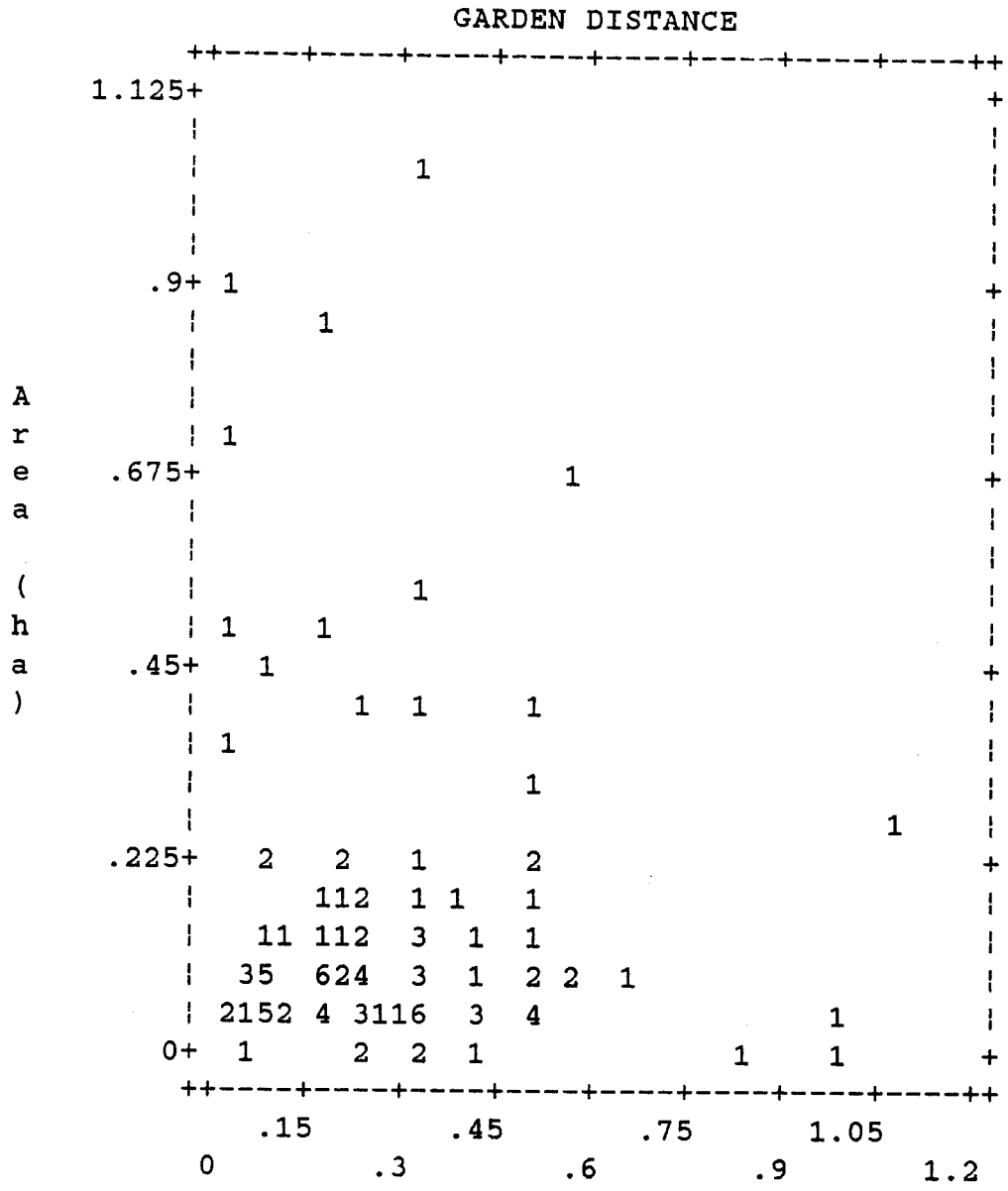
crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
beach		24		6	29
lowland platform		41		29	71
depression (poor drainage)					
swamp					
river channel					
uplifted terrace					
total by crop type		65		35	100

Note: The table of % area is only approximate due to rounding small numbers

12.4 The spatial distribution of gardens is shown in diagram 12.2 which shows the relationship between garden area (vertical axis) and the time taken to reach the garden from the household (horizontal axis), where entries represent the number of observations (gardens). These are numbered from 1 to 9 and thereafter alphabetically. 9 occurrences is recorded as "9"; 10 occurrences as "A"; 13 occurrences as "D"; and so on.

12.5 The mean time taken to reach gardens is .181 hours, or about 10 minutes, with a maximum time recorded of 1.05 hours. There is no strong relationship between garden size and distance since most gardens are close to the household. Tree crop gardens tend to be close to the household with a mean distance of .138 hours and a maximum recorded distance of .350 hours. Food crop gardens tend to be slightly further, with a mean distance of .200 hours and a maximum distance of 1.05 hours.

Diagram: 12.2



Mean = .181 hrs
Maximum = 1.05 hrs
Number of Observations (gardens) = 110

Chapter: 13
ADVERSE FACTORS AFFECTING PRODUCTION

13.1 Table 13.1 describes site factors which farmers regard as problems. The first part of the table specifies the number of observations (gardens), and the area affected is expressed as the proportion of cultivated area in the second part of the table.

Table: 13.1
SITE CONDITIONS

i) Site Conditions by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no site limitation		4		28	32
poor soil/site		5		15	20
pest/disease problem		1		8	9
poor site + pests		4		21	25
weed problem		11			11
weeds + poor site		2		2	4
weeds + pests		5			5
weeds + site + pests		2		2	4
total by crop type		34		76	110

ii) Site Conditions by % area of holding

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no site limitation		12		12	24
poor soil/site		12		6	18
pest/disease problem				6	6
poor site + pests		6		6	12
weed problem		18			18
weeds + poor site		6			6
weeds + pests		12			12
weeds + site + pests				6	6
total by crop type		65		35	100

Note: The table of % area is only approximate due to rounding small numbers

13.2 Only 29% of gardens (32 gardens) representing 24% of the cultivated area have no site limitations. Thus problems are encountered on 76% of the cultivated area. Site problems may be summarised by grouping the main factors as follows:

	% gardens	% area
No site limitations	29	24
Poor soil/site	48	42
Pests/disease	39	36
Weeds	22	42

13.3 The major problems are poor soils affecting 42% of the cultivated area, weeds also affecting 42% of the cultivated area, and pests and disease affecting 36% of the cultivated area. Site conditions are illustrated in diagram 13.1 showing that tree crops are badly affected bt all major problems, particularly weeds, but also that poor soil and pest and disease problems affect large areas of food crop gardens. 82% of the tree crop area is affected by various problems and 66% of the food crop area.

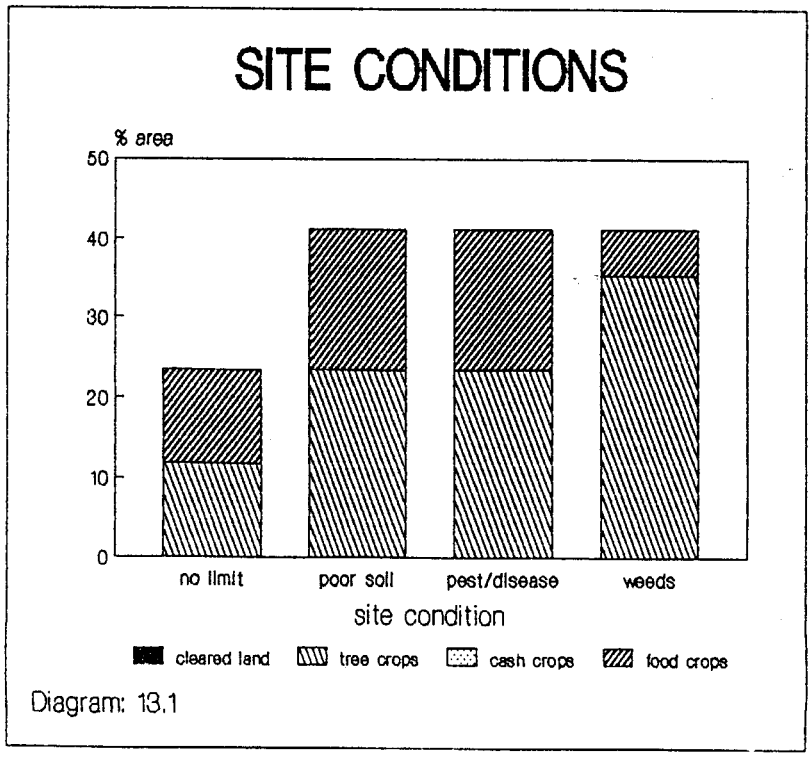


Diagram: 13.1

13.4 Table 13.2 summarises crop damage at the garden level in which **44%** of tree crop gardens were damaged, mainly by cyclone, extending over **46%** of the tree crop area. **17%** of the food crop area was also damaged by cyclone.

Table: 13.2
CROP DAMAGE

i) Crop Damage by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no damage		15		62	77
cyclone damage		18		9	27
other damage		1		5	6
cyclone and other damage					
total by crop type		34		76	110

ii) Crop Damage by % area of holding

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no damage		35		29	65
cyclone damage		24		6	29
other damage		6			6
cyclone and other damage					
total by crop type		65		35	100

Note: The table of % area is only approximate due to rounding small numbers
"Other" damage is predominantly drought/shallow soil/soil infertility damage

13.5 Table 13.3 describes insect damage to crops. The first part of the table shows the frequency of plots on which damage was encountered, and is expressed in terms of the total cultivated area in the second part of the table. The nature of damage is described in main columns by the part of the crop affected - which may be leaves, fruits or roots - each subdivided into severity of damage observed on the standing crop. To the right of the upper table, "frequency of plots" shows the total number of plots observed, including those for which there is no damage. The first row of each table summarises damage across all crops.

13.6 In the primary analysis it is necessary to simplify the presentation of results at this stage by expressing crop damage in terms of the dominant crop growing in often complex mixtures. Damage therefore refers to the plot, and usually but not necessarily to the named crop. Categories of damage are not exclusive, so that for instance a crop showing leaf damage may also have damaged fruits.

Table: 13.3

INSECT CROP DAMAGE

i) Insect Damage by frequency of damage encountered (plots)

part affected:		leaves			fruits			
extent of damage:		little	consid-erable	crop devastated	little	consid-erable	severe	crop devastated
all plots		57	18	1	59	19	1	1
cleared land	a							
coconut	b	5	2		8	6		
cabbage	g		1			1		
fruit trees	k				1			
banana	l	1						
nut trees	n				1			
sugar cane	o		1					
food/building tree	p	2			1	1	1	
tobacco	q							
sweet potato	r	37	9	1	35	3		2
yam	t	1						
pana	u	10	4		13	3		
cassava	v	1	1					

frequency (continued)

part affected:		roots			frequency
extent of damage:		little	consid-erable	crop devastated	of crops
all plots		25	5	1	152
cleared land	a				
coconut	b	2			30
cabbage	g				1
fruit trees	k				1
banana	l				1
nut trees	n				3
sugar cane	o				1
food/building tree	p				3
tobacco	q				1
sweet potato	r	15	4	1	69
yam	t	1			1
pana	u	7	1		36
cassava	v				2

ii) Insect Damage by % area affected

part affected:		leaves			fruits			
extent of damage:		little	consid-erable	crop devastated	little	consid-erable	severe	crop devastated
all plots		29	6		35	18		
cleared land	a							
coconut	b	12	6		12	18		
cabbage	g							
fruit trees	k							
banana	l							
nut trees	n				6			
sugar cane	o							
food/building tree	p							
tobacco	q							
sweet potato	r	18			12			
yam	t							
pana	u				6			
cassava	v							

% area affected (continued)

part affected:		roots		
extent of damage:		little	consid-erable	crop devastated
all plots		18		
cleared land	a			
coconut	b	12		
cabbage	g			
fruit trees	k			
banana	l			
nut trees	n			
sugar cane	o			
food/building tree	p			
tobacco	q			
sweet potato	r	6		
yam	t			
pana	u			
cassava	v			

Note: The table of % area is only approximate due to rounding small numbers

13.7 The most extensive damage is to coconut gardens, in which nuts are damaged to a greater or lesser extent over **46%** of plots extending over **30%** of the total cultivated area. Leaf and root damage are minor problems affecting around **50%** of the sweet potato and pana plots.

13.8 Table 13.4 is the corresponding table for disease damage.

Table: 13.4

DISEASE CROP DAMAGE

i) Disease Damage by frequency of damage encountered (plots)

part affected:		leaves			fruits		
extent of damage:		little	consid-erable	crop devastated	little	consid-erable	crop devastated
all plots		36	14	1	41	13	1
cleared land	a						
coconut	b	5	1		6	4	
cabbage	g		1			1	
fruit trees	k						
banana	l	1					
nut trees	n		1		1		
sugar cane	o		1				
food/building tree	p				1	1	
tobacco	q						
sweet potato	r	22	6	1	19	4	1
yam	t	1					
pana	u	7	2		9	4	
cassava	v						

frequency of damage (continued)

part affected:		roots				frequency
extent of damage:		little	consid-erable	severe	crop devastated	of crops
all plots		41	13	1	1	152
cleared land	a					3
coconut	b	2				30
cabbage	g					1
fruit trees	k					1
banana	l					1
nut trees	n					3
sugar cane	o					1
food/building tree	p			1		3
tobacco	q					1
sweet potato	r	28	10		1	69
yam	t	1				1
pana	u	9	3			36
cassava	v	1				2

ii) Disease Damage by % area affected

part affected:		leaves			fruits		
extent of damage:		little	consid-erable	crop devastated	little	consid-erable	crop devastated
all plots		24	12		24	12	
cleared land	a	///////	///////	///////	///////	///////	///////
coconut	b	18	6		12	12	
cabbage	g						
fruit trees	k						
banana	l						
nut trees	n		6		6		
sugar cane	o						
food/building tree	p						
tobacco	q						
sweet potato	r	6			6		
yam	t						
pana	u						
cassava	v						

% area affected (continued)

part affected:		roots			
extent of damage:		little	consid-erable	severe	crop devastated
all crops (total)		24			
cleared land	a	///////	///////	///////	///////
coconut	b	12			
cabbage	g				
fruit trees	k				
banana	l				
nut trees	n				
sugar cane	o				
food/building tree	p				
tobacco	q				
sweet potato	r	12			
yam	t				
pana	u				
cassava	v				

Note: The table of % area is only approximate due to rounding small numbers

13.9 The main disease damage again is on coconuts and sweet potato. Nut damage occurs on 33% of coconut plots and a hogh proportion of sweet potato area is damaged by disease.

13.10 Fire, flood and wind damage are described in table 13.5.

Table: 13.5

FIRE, FLOOD AND WIND CROP DAMAGE

i) Damage by frequency of damage encountered (plots)

part affected:		fire	flood	wind				
extent of damage:		(no damage)	(no damage)	little	consid-erable	severe	crop devastated	frequency of crops
all plots				10	12	4	1	152
cleared land	a							3
coconut	b			7	7	3		30
cabbage	g							1
fruit trees	k			1				1
banana	l							1
nut trees	n				1			3
sugar cane	o							1
food/building tree	p						1	3
tobacco	q							1
sweet potato	r			1	3	1		69
yam	t							1
pana	u			1	1			36
cassava	v							2

ii) Damage by % area affected

part affected:		fire	flood	wind			
extent of damage:		(no damage)	(no damage)	little	consid-erable	severe	crop devastated
all plots				12	18	6	
cleared land	a						
coconut	b			12	12	6	
cabbage	g						
fruit trees	k						
banana	l						
nut trees	n				6		
sugar cane	o						
food/building tree	p						
tobacco	q						
sweet potato	r						
yam	t						
pana	u						
cassava	v						

Note: The table of % area is only approximate due to rounding small numbers

3.11 There is no fire or flood damage, but wind damage affects 57% of coconut plots extending over 30% of the agricultural area.

13.12 Rat and bird damage are described in table 13.6.

Table: 13.6
RAT AND BIRD CROP DAMAGE

i) Damage by frequency of damage encountered (plots)

part affected:		rats			birds	
extent of damage:		little	consid-erable	severe	little	frequency of crops
all plots		9	41	15	2	152
cleared land	a					3
coconut	b	2	1	1	1	30
cabbage	g					1
fruit trees	k		1			1
banana	l				1	1
nut trees	n	1				3
sugar cane	o					1
food/building tree	p		1			3
tobacco	q					1
sweet potato	r	5	37	13		69
yam	t					1
pana	u	1		1		36
cassava	v		1			2

ii) Damage by % area affected

part affected:		rats			birds
extent of damage:		little	consid-erable	severe	little
all plots		12	12	6	
cleared land	a				
coconut	b	6			
cabbage	g				
fruit trees	k				
banana	l				
nut trees	n	6			
sugar cane	o				
food/building tree	p				
tobacco	q				
sweet potato	r		12	6	
yam	t				
pana	u				
cassava	v				

Note: The table of % area affected is only approximate due to rounding small numbers

13.13 There is little bird damage, but rats have caused damage on 80% of the sweet potato plots extending over 18% of the agricultural area. 6% of the agricultural area under coconuts and 6% of the agricultural area under nut trees is affected by rat damage.

13.14 Damage due to bats and livestock is described in table 13.7.

Table: 13.7
BATS AND LIVESTOCK DAMAGE
i) Damage by frequency of damage encountered (plots)

part affected:		bats			livestock	
extent of damage:		little	consid-erable	severe	little	frequency of crops
all crops (total)		10	16	2	9	152
cleared land	a					3
coconut	b	8	7		1	30
cabbage	g		1			1
fruit trees	k		1			1
banana	l					1
nut trees	n		1			3
sugar cane	o					1
food/building tree	p		1	1		3
tobacco	q					1
sweet potato	r	1	5	1	3	69
yam	t				1	1
pana	u	1			4	36
cassava	v					2

ii) Damage by % area affected

part affected:		bats			livestock
extent of damage:		little	consid-erable	severe	little
all crops (total)		12	18		
cleared land	a				
coconut	b	12	12		
cabbage	g				
fruit trees	k				
banana	l				
nut trees	n		6		
sugar cane	o				
food/building tree	p				
tobacco	q				
sweet potato	r				
yam	t				
pana	u				
cassava	v				

Note: The table of % area is only approximate due to rounding small numbers

13.15 There is little livestock damage, but bats have caused damage on **24%** of the agricultural area under coconuts and **6%** of the agricultural area under nut trees.

13.16 Human and other damage are summarised in table 13.8.

Table: 13.8

HUMAN AND OTHER DAMAGE

i) Damage by frequency of damage encountered (plots)

part affected:		other	human		
extent of damage:		little	little	considerable	frequency of crops
all crops (total)		2	9	4	152
cleared land	a				3
coconut	b		5	1	30
cabbage	g				1
fruit trees	k		1		1
banana	l				1
nut trees	n				3
sugar cane	o				1
food/building tree	p			1	3
tobacco	q				1
sweet potato	r	2	2	1	69
yam	t				1
pana	u		1	1	36
cassava	v				2

Note: "Other" damage is crabs

ii) Damage by % area affected

part affected:		other	human	
extent of damage:		little	little	considerable
all crops (total)			6	
cleared land	a			
coconut	b		6	
cabbage	g			
fruit trees	k			
banana	l			
nut trees	n			
sugar cane	o			
food/building tree	p			
tobacco	q			
sweet potato	r			
yam	t			
pana	u			
cassava	v			

Note: The table of % area is only approximate due to rounding small numbers

13.17 Scattered human damage is evident, but affects only 6% of the agricultural area under coconuts to a minor degree.

13.18 Table 13.8 describes crop management and the application of chemical inputs.

Table: 13.9

MANAGEMENT AND APPLICATION OF AGRICULTURAL INPUTS

i) Inputs by frequency of use (plots)

crop type		row planting	fert-iliser	pest-icide	manure	ash	other	frequency of crops
all crops (total)		23				1	7	152
cleared land	a							3
coconut	b	22				1	1	30
cabbage	g							1
fruit trees	k							1
banana	l							1
nut trees	n	1						3
sugar cane	o							1
food/building tree	p							3
tobacco	q						6	1
sweet potato	r							69
yam	t							1
pana	u							36
cassava	v							2

Note: "Other" is the use of nitrogen fixing tree Hibiscus tiliaceae for the restoration of nitrogen. Excluded household also applied some pig manure.

ii) Inputs by % area applied

crop type		row planting	fert-iliser	pest-icide	manure	ash	other
all crops (total)		35					
cleared land	a						
coconut	b	35					
cabbage	g						
fruit trees	k						
banana	l						
nut trees	n						
sugar cane	o						
food/building tree	p						
tobacco	q						
sweet potato	r						
yam	t						
pana	u						
cassava	v						

Note: The table of % area is only approximate due to rounding small numbers

13.19 Row planting is practiced on 73% of coconut plots. There is no use made of chemical inputs.

Chapter: 14
CROP YIELDS

14.1 Production data on smallholder agriculture are scarce, largely due to practical difficulties associated with measuring yields in complex cropping systems that lack clear temporal and spatial boundaries. Smallholder agriculture is a continuous process in which there is little seasonality, so that any or all stages of crop growth and management operations may be exhibited at any time, with crops commonly harvested selectively over time. Table 14.1 summarises the planting characteristics of smallholder crops in the survey area.

Table: 14.1
CROP VARIETY AND SPACING

crop type		number of observations	% improved	spacing customary	spacing regular	spacing (% obs) recommended tree crops triangular	spacing (% obs) recommended tree crops square
Cleared	Cleared land	1					
Coconut/Cocoa	Coconuts	35	3	26	54	3	17
Ground crops	Grain crops	1			100		
	Beans	1		100			
	Cabbage	26		100			
	Fruit Crops	40		98			3
Tree/other crops	Fruit trees	28		96	4		
	Banana	37		100			
	Citrus trees	2		100			
	Nut trees	49		98	2		
	Sugar cane	14		100			
	Food/building tree	44		98	2		
	Tobacco	2		100			
Root crops	Sweet potato	70		99	1		
	Taro Common	2		100			
	Giant Hong Kong Swamp	1		100			
	Yam	6		100			
	Pana	43		100			
	Cassava	38		97		3	
	Other root crop						
Total		440					

14.2 The second column refers to the introduction of non-traditional planting material, either through extension or research, or from other sources. Essentially all crops are "traditional"

14.3 For non-tree crops there are three types of spacing identified, being "customary", "regular" and "recommended". "Customary" means there is no discernable order in the plot. "Regular" means planting according to a visible pattern, such as in rows. "Recommended" refers to the adoption of recommended practices, which may not necessarily be "regular". For tree crops there are four categories of "customary", "regular", "triangular" and "square". "Customary" and "regular" follow the same rules as non-tree crops. "Triangular" and "square" equate with recommended practices for coconuts.

14.4 In the survey area **26%** of coconut plots were planted according to "custom", without discernable order. **20%** were planted either square or triangular, with the remaining **54%** showing some order but not according to established recommendations. Other crops, are mostly planted according to custom.

14.5 Crop mixtures in smallholder farming systems are complex, as seen in table 9.3. Table 14.2 shows this in the form of planting densities. In most cases crops are less than 50% dominant, and are commonly less than 20% dominant, showing that many crops are grown together in mixtures. Only **37%** of coconut coconut plots are pure stand, **23%** of sweet potato plots and **63%** of pana plots.

Table: 14.2
CROP DOMINANCE IN MIXTURES

crop type		number of observations	% dominance in mixture									
			0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
Cleared	Cleared land	1										
Coconut/Cocoa	Coconuts	35	6		3		17	9	14	3	11	37
Ground crops	Grain crops	1			100							
	Beans	1	100									
	Cabbage	26	77	15	4		4					
	Fruit Crops	40	80	8	5	3	3					3
Tree/other crops	Fruit trees	28	39	18	21	14	4		4			
	Banana	37	68	14	5	5	8					
	Citrus trees	2	50	50								
	Nut trees	49	47	16	18	14	2				2	
	Sugar cane	14	57	21	14							7
	Food/building tree	44	52	16	18		5	2			5	2
	Tobacco	2	50									50
Root crops	Sweet potato	70	1	1		4	6	9	7	19	30	23
	Taro Common	2	50	50								
	Giant	1			100							
	Hong Kong											
	Swamp											
	Yam	6	17	67								17
	Pana	43	5	12		2	2	2	2	5	7	63
	Cassava	38	66	16	8	5	3			3		
	Other root crop											
Total		440										

14.6 A visual assessment of yields is presented in table 14.3.

Table: 14.3
CROP PRODUCTION

crop type		number of observations		yield appearance (% obs)		
		total	zero yield	low	moderate	high
Cleared	Cleared land	1				
Coconut/Cocoa	Coconuts	35	6	59	41	
Ground crops	Grain crops	1		100		
	Beans	1		100		
	Cabbage	26	1	44	52	4
	Fruit Crops	40	6	38	50	12
Tree/other crops	Fruit trees	28	1	7	56	37
	Banana	37	4	27	64	9
	Citrus trees	2		50	50	
	Nut trees	49		20	55	24
	Sugar cane	14		50	50	
	Food/building tree	44	3	5	59	37
	Tobacco	2				100
Root crops	Sweet potato	70	5	66	32	2
	Taro Common	2		50	50	
	Giant Hong Kong Swamp	1			100	
	Yam	6			50	50
	Pana	43	1	29	60	12
	Cassava	38	8	83	13	3
	Other root crop					
Total		440	35	= 8 % zero		

14.7 Most yield observations are "low" to "moderate", with a minority of cases where yields are high. Poor soils, pests and disease are largely responsible for low yields.

14.8 With limited time in the field it is difficult to obtain a reasonable coverage of crop yields, although these are recorded where possible in the course of the survey[12]. A crop production study has been designed to generate yield data[22] but it has not been possible to implement this yet. For the present report yields are derived from secondary sources.

a) COCONUT:

14.9 Coconut production data from the 1974-75 agricultural survey are summarised in table 14.4.

Table: 14.4
COCONUT PRODUCTION DATA FROM 1974-75 AGRICULTURAL SURVEY

	Province				Mean
	Western	Ysabel Central Guadalcanal	Malaita	Makira Temotu	Solomon Islands
number of yield sites	28	32	3	30	93
coconuts per palm: disciplined	53	54	19	34	44
customary	22	36	1	41	31
mean	31	42	14	37	36
coconuts per ha : disciplined	8,194	8,983	2,822	5,773	7,178
customary	4,658	8,595	135	7,432	6,703
mean	5,794	8,753	1,926	6,492	6,913
% damaged/unusable nuts: disciplined	12	10	12	20	14
customary	19	13	36	6	13
mean	16	12	12	13	14
gross copra yield (kg/ha): disciplined	1,541	1,689	531	1,086	1,450
customary	876	1,616	25	1,398	1,261
mean	1,081	1,646	362	1,221	1,300
net yield (kg/ha): disciplined	1,356	1,520	467	869	1,247
customary	709	1,406	16	1,314	1,097
mean	908	1,448	318	1,062	1,118

Source: Statistics Office (1978) "1974-75 Agricultural Statistics Survey".
Note: Copra yields assumse 190gm dried copra per nut quoted in the Statistics Office report

14.10 In the 1974-75 agricultural survey the mean coconut yield is estimated to be **1,300kg/ha** copra equivalent, or **1,118kg/ha** when unusable nuts are discounted. The average daily consumption of coconuts was found to be **4.2** per household, resulting in a national annual consumption equivalent of **8,871MT** copra. If green nuts are taken into account it was believed that the copra equivalent consumed would be **10,000MT**[5] in a year when exports amounted to **28,000MT**.

14.11 Charles (1980) estimates lower levels of copra production with estate yields of **827kg/ha** and smallholder yields of **410kg/ha** The difference he attributed to a high proportion of immature plantings and the consumption of coconuts in the smallholder sector[23]. Average copra production derived from the 1985 coconut survey is estimated in the (draft) Farm Management Handbook for Solomon Islands to be **0.72MT/ha**[24], although provincial yields vary from **1.15MT/ha** in Central Province, which is dominated by the Levers plantation in the Russel Islands, to **0.38MT/ha** in Temotu.

14.12 In conjunction with the 1985 coconut survey the Research Department of the Ministry of Agriculture and Lands has analysed the nutritient status of coconut soils soils in Solomon Islands[13]:

Coconut Soils Data:
(means of soils analyses conducted on Coconut Survey soils)

pH	N%	availalble P ppm	exchangeable K meq/100g	availalble K meq/100g
6.4	0.55	70	0.24	0.60

14.13 It was concluded that coconut soils are generally high in nitrogen, medium in phosphate, and low in potassium. In Reef Islands soils are likely to be low in available phosphate.

14.14 In the present study copra yields were recorded on 13 sites with a mean yield of 25 bags per hectare, or **1,750 kg/ha.** It is difficult, however, to equate production with area and the yield may be over estimated.

14.15 Smallholder yields in the present report are estimated to be **800kg/ha** dry copra equivalent usable nuts, of which **350kg** equivalent might be consumed.

b) SWEET POTATO:

14.15 Sweet potato has become an important staple in the Reef Islands and has grown in importance over the past 30 or so years. It is generally a high yielding crop which is relatively undemanding to manage. In Reef Islands it has become associated with the declining fertility of soils as a result of over intensive cultivation, and yields have fallen drastically over wide areas.

14.16 Smallholder sweet potato yields are estimated in other AES farming systems survey areas to be **8MT/ha** of net usable crop under long fallow of 8 years or more - falling to **5MT/ha** for fallow of 4 to 8 years, and **3.5MT/ha** for short fallow cropping. These yields are unlikely to be representative of Reef Islands, however, since they are based for the most part on sites with fertile soils of igneous parent material. Reef Islands soils are shallow and calcareous, overlain to a greater or lesser extent by volcanic topsoil. The fertility of Reef Islands soils is dependent on organic matter content, and therefore is considerably affected by the extent of disturbance and intensity of cropping. Thus it is possible to find good yields on newly opened sites but very poor yields on repeatedly cropped sites.

14.17 The majority of yields in table 14.3 are low to medium. The only measured sweet potato yield was on a 0.168ha plot in which sweet potato is 70% dominant. The yield from a 107 sq m sub-plot was 10.0kg. This amounts to a yield of **935 kg/ha** or **1,335 kg/ha** when corrected for dominance.

14.18 Yields are generally low. On fertile or newly opened sites good yields, possibly in excess of **5 MT/ha** may be obtained. Most areas will probably have yields of **3 - 5 MT/ha**, falling to as low as **1 MT/ha** on repeatedly cropped sites.

c) TARO:

14.19 Taro is a minor crop in Reef Islands although the dryland giant taro Crytosperma is grown under trees[31]. Studies from elsewhere are unlikely to be applicable to local conditions. Yields in the literature are highly variable. Frazer[15] found Colocasia esculenta to yield **8.94MT/ha** in North Malaita, based on 10 observations. Gollifer[16] on the Dala Series in Malaita found yields of **4.0MT/ha** for unfertilised taro, which increased to **6.0MT/ha** with 168kg/ka potassium fertiliser applied. Gollifer[17] also quotes widely ranging unfertilised taro yields of **1.00** to

10.80MT/ha on experimental plots. In a spacing trial in Guadalcanal at Tenaru on which fertiliser was applied, the net undamaged taro yield for densities of 2,000 to 4,000 plants/ha was around **5MT/ha**, with 30% loss due to corm damage[14]. On the same site a high intensity inputs and management trial to investigate leaf blight yielded around **9MT/ha** marketable corms[14]. The control yield in a 1985 taro beetle trial at Tenaru was **3.49MT/ha**[13]. Tioti (1967) estimated taro yields to be **12.6MT/ha**[25], but Gollifer (1970) quotes yields of **4.7MT/ha**[26].

14.20 The smallholder pure stand taro yield in other farming systems survey areas is estimated to be **5MT/ha**.

d) **YAM**:

14.21 No yam yields were obtained. Yams in Reef Islands are commonly perennial shade tolerant wild yams which are well adapted to growing in association with trees. They are slow growing and are often widely spaced, and therefore would be low yielding in terms of production per hectare. The importance of yams is that they fill an ecological niche and make an important contribution in multi-layer tree crop production systems. They are generally harvested continually without damaging the growing plant. The productivity of such multi-layer systems is to be studied further[31].

14.22 In other areas covered by the farming systems survey smallholder pure stand yam yields are estimated to be **10MT/ha** under long fallow, **6MT/ha** on sites with fallow of 4-8 years, and **4MT/ha** on sites with short fallow. These would apply only to *Diosorea alata* grown in the open, under conditions which are not representative of the Reef Islands.

e) **PANA**:

14.23 Pana is the second most important root crop to sweet potato. As with yams, perennial wild pana are grown in association with trees.

14.24 Frazer[15] quotes a for North Malaita, where on one observation only of *Dioscorea esculenta* produced a yield of **11.52MT/ha**. Fertilised cultivar trials at Dodo Creek Research Station[14] in 1984 yielded **16.2MT/ha** marketable tubers out of a total yield of **27.7MT/ha**. 1983 results were higher, with

43.7MT/ha marketable tubers out of a total yield of 52.9MT/ha. The difference was believed to be due to inadequate fertiliser in 1984. In 1985 the mean fertilised yield of 8 cultivars was 24.3MT/ha marketable tubers[13].

14.25 Smallholder pana yields in table 14.3 are mostly moderate and so pure stand pana yields are estimated to be 3 - 5 MT/ha.

f) CASSAVA:

14.26 Fertilised cassava in a time of harvest trial at Dodo Creek in Guadalcanal[13] yielded 23.8MT/ha after 9 months and 27.8MT/ha after 12 months. In a fertilised germplasm collection trial on the Fataolo land system on Malaita 17 cultivars ranged from 7.5 to 65.8MT/ha, with 50% above 40MT/ha[28].

14.27 Cassava is tolerant of low fertility and is a minor crop planted at low densities in mixtures. It is mostly low yielding according to table 14.3. Smallholder yields in Reef Islands are estimated to be 5 MT/ha equivalent pure stand.

g) SUMMARY OF YIELDS:

14.28 Crop yields derived from secondary sources are necessarily imprecise in the present context because of the complexity of smallholder farming systems and the nature of soils in Reef Islands. Diverse crop mixtures, with varying crop densities and differing site conditions do not lend themselves to a simple analysis of crop yields or smallholder production. Crop yields in the literature are generally for pure stand crops, or very simple mixtures - under controlled or even modified conditions. There is then a need to study smallholder production under more realistic conditions in the on-going programme of the Agricultural Economics Section[22]. In the meantime, a "best estimate" of typical smallholder yields in the project area is presented in table 14.5.

Table: 14.5
SMALLHOLDER CROP YIELDS

crop	condition	yield kg/ha
coconut	copra equivalent	800
sweet potato	> 8 years fallow	5,000
	4 - 8 years fallow	3-5,000
	< 4 years fallow	1-3,000
taro		5,000
pana		3-5,000
cassava		5,000

Chapter: 15
SMALLHOLDER PRODUCTION

15.1 Under the Rural Services "Project Benificiary Monitoring and Evaluation" undertaken by the Statistics Office, gross crop offtake and other primary production were measured on six of the Rural Development Centre sites. These are not representative of Reef Islands conditions and so are not presented here.

15.2 From table 9.2 the average root crop area in the survey area is **0.142ha** of which sweet potato is dominant on **0.098ha**, pana on **0.040ha**, and cassava and yam account for the rest. All crops occur in complex mixtures, so that simple cropping patterns can only be used as a first approximation for the actual crop coverage.

15.3 Table 15.1 is a summary of available production data from the farming systems survey. It is not possible to directly relate aggregate production data to average cropping patterns until a more detailed analysis of smallholder production is available.

Table: 15.1
SMALLHOLDER PRODUCTION SUMMARY

commodity	area (ha)	growing period (months)	annual production (kg)
sweet potato	0.098	3.7	
cassava	0.003	6.0	
yam	0.001	5.0	
pana	0.040		
taro			
breadfruit			
banana	0.001		
Source table:	9.2	11.3	

Chapter: 16
LABOUR

16.1 With no cash inputs applied in the farming systems under study, the main component in the socio-economy of smallholder agriculture is labour. Table 16.1 presents an overview of labour constraints expressed by farmers. The first part of the table shows the frequency of gardens affected and is expressed in terms of area affected in the second part.

Table: 16.1
LABOUR CONSTRAINTS

i) Labour Constraints by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no limitation		19		59	78
lack of labour		2		5	7
lack of inputs/cash		12		10	22
lack of labour + cash		1		1	2
garden too far from house				1	1
garden too far + labour					
garden too far + cash					
too far + labour + cash					
total by crop type		34		76	110

ii) Labour Constraints by % area of holding

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no limitation		41		24	65
lack of labour		6			6
lack of inputs/cash		18		6	24
lack of labour + cash				6	6
garden too far from house					
garden too far + labour					
garden too far + cash					
too far + labour + cash					
total by crop type		65		35	100

Note: The table of % area is only approximate due to rounding small numbers
"Food crops" refers to annual crops.

16.2 Diagram 16.1 summarises labour constraints by area, and refers to the "average" holding of 0.429ha defined in table 9.2, in which 65% is predominantly tree crops and 35% is predominantly annual food crops.

16.3 Labour density has been shown to be high in chapter 8, although weeds are a problem on tree crops in chapter 13. Labour is not in general limiting, and the major problem is the ability to sustain the livelihood of farming families on small holdings. Diagram 16.1 clearly shows that the distance of gardens from households is not a constraint and that labour is very rarely a constraint. Labour is a limitation affecting only **9%** of tree gardens and **9%** of the tree garden area. Labour availability is a limitation on **8%** of annual food crop gardens and **17%** of the food crop garden area.

16.4 A shortage of inputs or cash is recorded on **38%** of tree gardens representing **28%** of the tree garden area. **15%** of annual food crop gardens have a problem from a shoratge of inputs or cash affecting **34%** of the food garden area.

16.5 Table 16.2 summarises the labour requirements of the average holding, derived from individual plot labour studies presented in annex 2. The table is a "model" budget representing the average of complex and diverse holdings. Individual crop budgets in annex 2 may be used to construct farm budgets for hypothetical holdings, but caution should be exercised where there are few observations. Labour days in budgets presented here are based on actual hours worked per day, which are quite variable. Again, tables in annex 2 may be used to convert work hours into "standard" work days if required. Since table 16.2 represents the average holding, crops which comprise only minor mixtures in cropping patterns do not appear in the summary labour budget.

16.6 The table shows the labour requirement of each agricultural operation according to crop, which may be a pure stand or more commonly the dominant crop in a mixture. Agricultural operations cover: land clearance; cultivation; planting; first, second and third weeding; and harvesting. For some crops - notably, but not exclusively, trees - there may be additional operations such as pruning or thinning which do not easily fall within the standard classification. Two general categories of establishment and maintenance operations are therefore included. Such a classification provides good coverage for most activities and allows diverse crops to be handled in a standard manner.

Table: 16.2
ANNUAL LABOUR INPUT BY HOLDING

	work days per year per holding				per ha	% contribution			labour cost
	men	women	paid	total	average	men	women	paid	(SI$)
i) Land Clearance									
Cleared land					80				
Coconut	5			5	20	100			
Fruit trees					13				
Nut trees					17				
Sugar cane					405				
Food/building tree	1			1	67				
Sweet potato	12	3		15	157	80	20		
Pana	8	3		11	271	73	27		
Cassava					48				
Total holding	26	6		32	179	81	19		
ii) Cultivation									
Cleared land									
Coconut	4			4	15	100			
Fruit trees					33				
Nut trees	1			1	50	100			
Sugar cane					270				
Food/building tree	1			1	58	100			
Sweet potato	11	6		17	167	65	35		
Pana	10	4		14	346	71	29		
Cassava					38				
Total holding	27	10		37	220	73	27		
iii) Planting									
Cleared land									
Coconut	3			3	14	100			
Fruit trees					33				
Nut trees	1			1	34	100			
Sugar cane					270				
Food/building tree	1			1	58	100			
Sweet potato	9	7		16	167	56	44		
Pana	4	6		10	256	40	60		
Cassava					38				
Total holding	18	13		31	187	58	42		

ANNUAL LABOUR INPUT BY HOLDING (continued)

	work days per year per holding men	women	paid	total	per ha average	% contribution men	women	paid	labour cost (SI$)
iv) Establishment									
Cleared land									
Coconut	1			1	3	100			
Fruit trees					24				
Nut trees					4				
Sugar cane									
Food/building tree					27				
Sweet potato	3			3	28	100			
Pana									
Cassava									
Total holding	4			4	9	100			
v) Maintenance									
Cleared land									
Coconut	3			3	11	100			
Fruit trees					17				
Nut trees					4				
Sugar cane									
Food/building tree					6				
Sweet potato									
Pana									
Cassava									
Total holding	3			3	10	100			
vi) First Weeding									
Cleared land									
Coconut	3			3	13	100			
Fruit trees					20				
Nut trees									
Sugar cane					270				
Food/building tree					7				
Sweet potato	6	11		17	174	35	65		
Pana	1	4		5	113	20	80		
Cassava					38				
Total holding	10	15		25	122	40	60		

ANNUAL LABOUR INPUT BY HOLDING (continued)

	work days per year per holding				per ha	% contribution			labour cost
	men	women	paid	total	average	men	women	paid	(I)
vii) Second Weeding									
Cleared land									
Coconut	5			5	20	100			
Fruit trees					28				
Nut trees									
Sugar cane					270				
Food/building tree					7				
Sweet potato	5	9		14	149	36	64		
Pana	1	6		7	160	14	86		
Cassava					38				
Total holding	11	15		26	141	42	58		
viii) Third Weeding									
Cleared land									
Coconut	2			2	7	100			
Fruit trees									
Nut trees									
Sugar cane					270				
Food/building tree					9				
Sweet potato	3	4		7	76	43	57		
Pana									
Cassava									
Total holding	5	4		9	50	56	44		
ix) Harvesting									
Cleared land									
Coconut	27	10		37	150	73	27		
Fruit trees					10				
Nut trees					13				
Sugar cane					10811				
Food/building tree		1		1	109		100		
Sweet potato	13	139		152	1547	9	91		
Pana	11	40		51	1267	22	78		
Cassava		1		1	306		100		
Total holding	51	191		242	1253	21	79		

16.7 In the interpretation of labour budgets it should be remembered from chapter 9 that while coconuts account for 57% of the cropped area they are grown by only 62% of farmers. Thus the majority of coconut cropping farmers will require more labour on tree crops than specified, while non-coconut cropping farmers will not require any. Labour budgets are also presented on the basis of labour input "when operations are performed". Adjustment is not made to the labour input to take account of operations which are omitted, forinstance where a proportion of plots are not weeded a second or third time. The number of observations on which labour operations are based in annex 2 provides a guide to the relative frequency that operations are performed, and so adjustments can be made to budgets based on different assumptions about management intensity. Incorporating this into the present analysis would considerably increase the complexity of presentation while introducing ambiguity into the results.

16.8 Results from the Reef Islands are distinctive in showing very low levels of labour expenditure. This is due in part to the widespread occurrence of perennial crops, partly to the limited area of fallow land and poor regrowth, but is mainly due to the very small holding sizes encountered. Labour data are indicative of high land pressure and under-employment in crop production as a result of constraints on the availability of land. Results are also characterised by the dominance of sweet potato and pana, and to a lesser extent coconut, in the crop budget. Most operations account for very little labour expenditure, there is no occurrence of hired labour, and harvesting is the dominant operation in the labour budget. Since it is mostly women that work with sweet potato and pana, and who are involved in harvesting operations, women account for 62% of the household labour despite having a lower labour availability.

16.9 The two main root crops require a higher absolute amount of labour than coconuts despite their small areas due to a much higher labour requirement per unit area. Coconut accounts for 16% of the labour expended in land clearance, requiring only 5 work days per year. The two main root crops of sweet potato and pana account for 81% of labour expended on clearance, requiring 53 work days per year. On a unit area basis the labour requirement of root crops is very much higher than that of coconut. Sweet potato accounts for 157 work days per hectare compared with 271 workdays per hectare for pana and 20 work days per hectare for coconuts. Men contribute most of the labour on land clearance. Of 32 work days, men contribute 81% compared to to 19% from women.

16.10 Root crops dominate the labour budget on cultivation, requiring 31 work days compared with 4 days for coconuts, indicating that land is limited for the planting of coconuts. This can be seen in the relatively old age composition of coconut stands in chapter 10. On a per hectare basis the requirements of root crops are again much higher than coconuts. Of 37 work days per year men contribute 73% and women 27%. Men contribute most labour on cultivation over the entire range of crops, including tree and root crops.

16.11 84% of the labour expended in planting is on root crops, accounting for 26 work days per year, or 84% of labour expended on planting. Of 31 work days per year required on planting throughout the holding, men contribute 58% and women contribute 42%. Men and women share the planting of root crops while men are mainly responible for the planting of other crops.

16.12 Only 4 days per year are spent by men on the establishment of crops, mainly on tree crops planted into sweet potato gardens. An increasingly common occurrence is to plant trees during the cropping of annual crops in order to establish tree gardens rather than allowing land to revert to fallow. This will increase the productivity of land and is a move towards the re-establishment of "traditional agriculture" in the Reef Islands.

16.13 3 work days are spent per year by men on the maintenance of coconut.

16.14 25 work days are spent on the first weeding of crops, of which 22 days are accounted for by root crops. Labour is mainly supplied by women, who contribute 60% of the labour on first weeding and most of the labour on root crops.

16.15 26 work days are spent on the second weeding of crops, of which 21 days are on on root crops. Women provide 58% of labour on second weeding, compared with 42% from men and perform most of the weeding of root crops. Again men participate in the weeding of root crops but are entirely responsible for the brushing of coconuts.

16.16 9 work days are spent on third weeding, of which men and women contribute about equal amounts, although men are again responsible for the brushing of coconuts.

16.17 The dominant operation in the labour budget is harvesting, which accounts for **242** work days, mostly by women. Men account for **21%** of labour in harvesting compared with **79%** from women. Women provide most of the labour on harvesting root crops and assist on tree crops. Women provide **191** harvesting labour days to **51** days from men.

16.18 A labour summary presented by crop and by operation in table 16.3. Overall there are **409** work days per year required on the average holding of which **155** are provided by men and **254** by women. Taking account of respective labour availability in the household, the average adult man in the household spends **62** days working on the holding and the average adult woman spends **128** days.

16.19 Men contribute **38%** of farm labour compared to **62%** from women. Per unit labour women work about twice as much as men.

Table: 16.3
SUMMARY OF LABOUR INPUT

	⟨------ work days per year -----⟩ ⟨----- per holding -----⟩				⟨- % contribution -⟩			labour cost
	men	women	paid	total	per ha average	men	women	paid	(SI$)
i) By Crop									
Cleared land					80				
Coconut	53	10		63	256	84	16		
Fruit trees					174				
Nut trees	2			2	122	100			
Sugar cane					12566				
Food/building tree	3	1		4	328	75	25		
Sweet potato	62	179		241	2465	26	74		
Pana	35	63		98	2413	36	64		
Cassava		1		1	506		100		
All Crops	155	254		409	2171	38	62		
ii) By Operation									
Land Clearance	26	6		32		81	19		
Cultivation	27	10		37		73	27		
Planting	18	13		31		58	42		
Tree Crops Establishment	3			3		100			
Tree Crops Maintenance	4			4		100			
First Weeding	10	15		25		40	60		
Second Weeding	11	15		26		42	58		
Third Weeding	5	4		9		56	44		
Harvesting	51	191		242		21	79		
All Operations	155	254		409		38	62		
Available labour units	2.49	1.99							
Days per unit labour	62	128							

16.20 Labour by crop is illustrated in diagram 16.2. Sweet potato accounts for **59%** of the holding labour budget with a requirement of **241** work days per year. Pana requires a further **98** work days per year, and coconut required 63 work days. Men provide **84%** of the labour on coconuts and around **30%** of the labour on root crops, while women provide **16%** of the total labour on coconuts and about **70%** of the labour on root crops. Overall men contribute **38%** of labour and women provide **62%**.

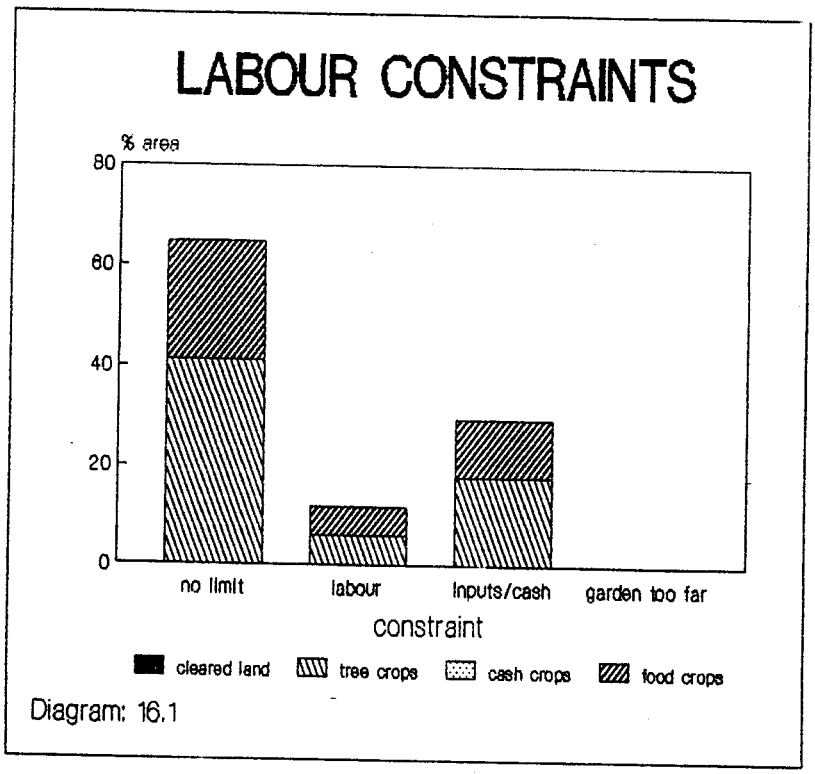


Diagram: 16.1

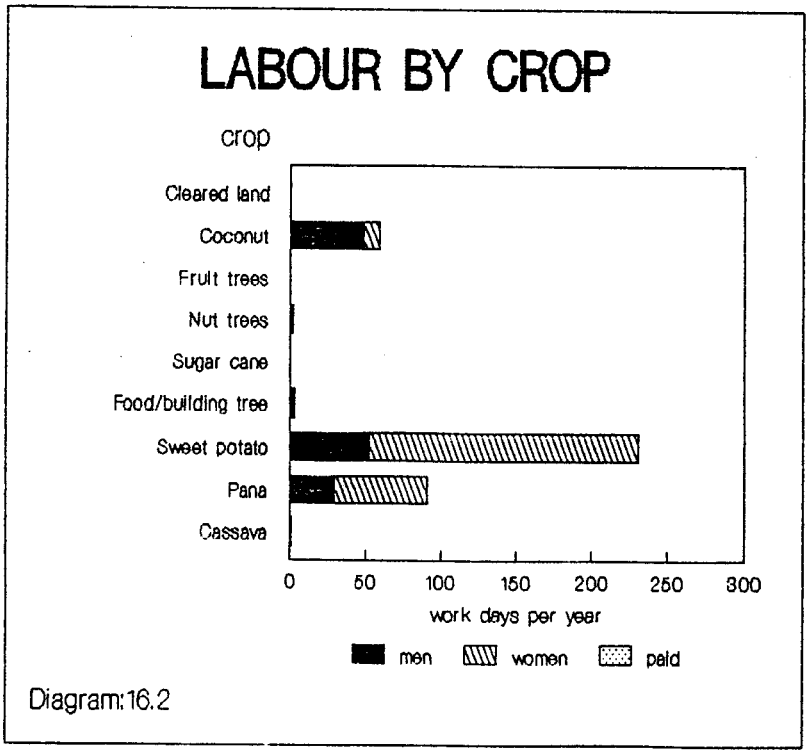


Diagram:16.2

16.21 Labour by operation is illustrated in diagram 16.3, showing the dominance of harvesting in the labour budget and the major contribution from women. Men provide most labour on clearance, cultivation and tree crops maintenance while women provide most labour on the weeding and harvesting of root crops.

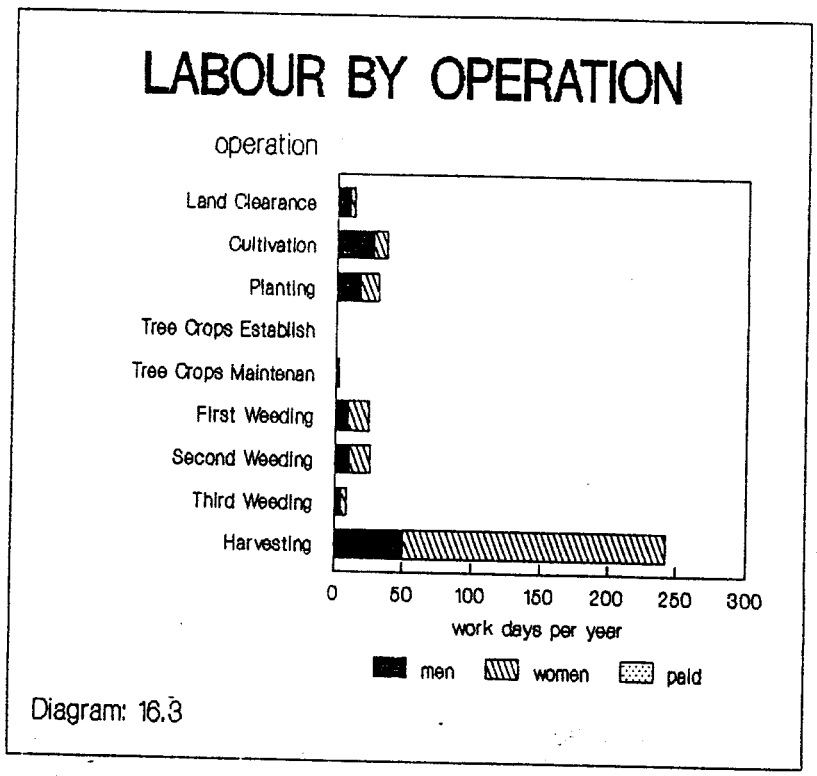


Diagram: 16.3

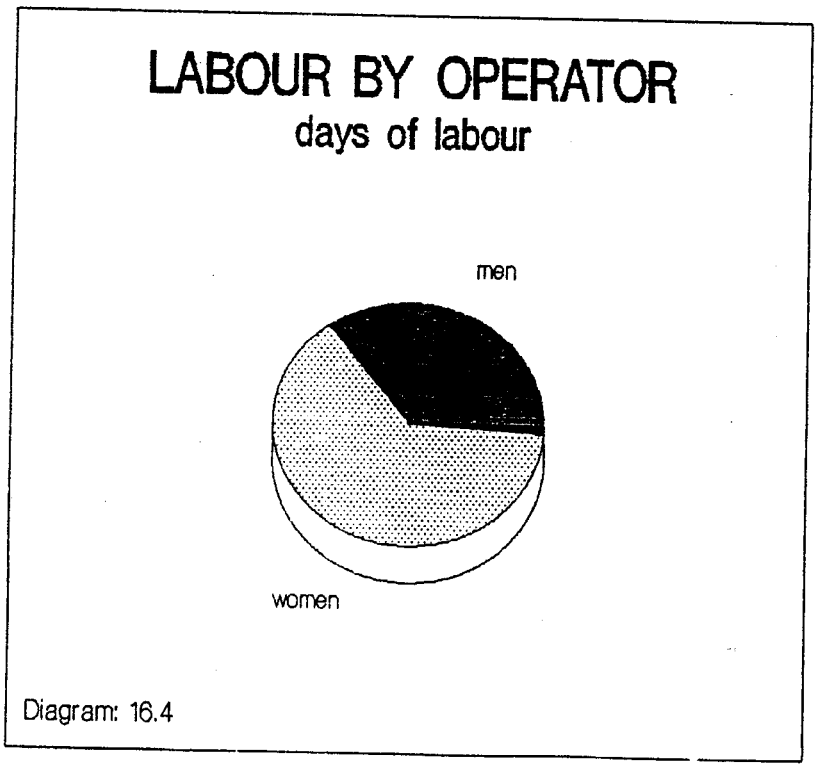


Diagram: 16.4

Chapter: 17
CROP AND FARM BUDGETS

17.1 It is possible only to provide background for the construction of crop and farm budgets at this stage because of the complexity and diversity of cropping patterns. A summary of information on cropping patterns, production and labour is presented in Table 17.1 where source references to tables in the text shown at the foot of the table.

Table: 17.1
ELEMENTS OF A FARM BUDGET

main crop in mixture	area (ha)	annual production (kg)	annual labour	
			work days	cost (SI$)
a Cleared Land	0.005			
b Coconut	0.244		63	
c Cocoa				
d Pasture				
e Grain Crops				
f Beans				
g Cabbage	0.002			
h Vegetables				
i Spices				
j Fruit Crops	0.004			
k Fruit trees				
l Banana	0.001			
m Citrus trees				
n Nut trees	0.021		2	
o Sugar cane				
p Food/building tree	0.010		4	
q Tobacco				
r Sweet Potato	0.098		241	
s Taro				
t Yam	0.001			
u Pana	0.040		98	
v Cassava	0.003		1	
w Other root crop				
Total	0.429		624	17
Table reference	9.2	not available	16.3	16.3

Chapter: 18
CASH CROP PROCESSING

18.1 Table 18.1 presents a labour budget for the production of copra based on 11 observations. 36% of sampled farmers earn income from copra (from table 4.2) although the proportion of farmers growing coconuts is 62%.

18.2 The labour input in the production of copra is 77% family and 23% hired, at an annual cash cost of SI$8.1. Hired labour is employed for husking, while all operations are performed by family labour.

18.3 Copra manufacture is labour intensive, requiring 191 work days per annum to produce 602kg copra, or one work-day per 3kg copra produced. 90 work days are spent on harvesting and shelling the nuts which account for 43% of the total production time. Firewood collection takes 27 days or 13% of the time; and drying, bagging and transport take 74 days or 35% of the time. The annual labour input is illustrated in diagram 18.1.

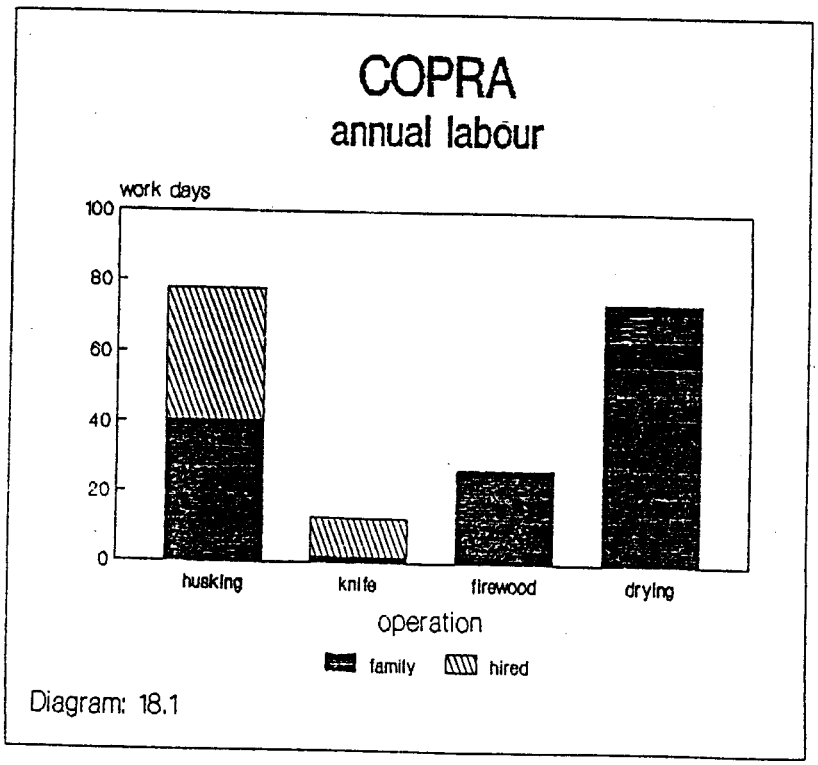


Diagram: 18.1

Table: 18.1

ANNUAL COPRA PRODUCTION AND LABOUR EXPENDITURE

Annual Labour Expenditure		family or shared labour		hired labour		total	% labour by operation
		work hours	work days	work days	cash cost ($.c)	work days	
HUSKING	picking, heaping	60.5	17.8			17.8	9
	husking	29.8	6.3	17.3	2.41	23.5	11
	transport	21.0	5.6	8.2	1.50	13.7	7
	breaking	20.0	6.0	2.7	0.59	8.7	4
	shelling	17.1	4.6	9.1	0.91	13.7	7
	total	148.4	40.3	37.3	5.4	77.6	37
COPRA KNIFE	picking, heaping	13.1	1.6			1.6	1
	axing + copra knife			5.5	1.36	5.5	3
	transport			5.5	1.36	5.5	3
	total	13.1	1.6	10.9	2.7	12.5	6
FIREWOOD	collection	16.0	2.7			2.7	1
	transport	9.6	2.1			2.1	1
	collection + transport	92.9	22.0			22.0	11
	total	118.5	26.8			26.8	13
DRYING	drying	195.3	65.9			65.9	32
	bagging	14.0	5.1			5.1	2
	transport	11.8	2.9			2.9	1
	total	221.0	73.9			73.9	35
TOTAL		501.0	147.2	48.2	8.1	190.8	100
% labour by type of labour			75	25		100	

copra grade	quantity of copra produced (kg)	
	per annum	per work day
Grade 1	310	2
Grade 2	6	0
Grade 3		
Ungraded	287	2
total	602	3

Number of observations = 11

18.4 The gross margin for copra production is summarised in table 18.2. From an annual production of **602kg** valued at the prevailing price of 33 cents per kilo the gross return is **SI$199.** Inputs costs from bags and twine amount to **SI$17.28** and labour costs are **SI$8.10.** The net income is **SI$182** which, at a requirement of **143** household labour days, represents a net return to labour of **SI$1.27** per household work day.

Table: 18.2
COPRA GROSS MARGIN

Annual production (kg)	602
Price per kilogram (SI$)	0.33
Gross return (SI$)	199
Inputs cost (SI$)	9.18
Labour cost (SI$)	8.10
Net return (SI$)	182
Household labour days	143
Copra production per household work day (kg)	4.20
Net return per household work day (SI$)	1.27

Inputs costs: Sacks @ SI$1.00 per new sack;
Average packed weight 70kg = 9 sacks = SI$9.00.
Twine @ SI$1.00 per hank of 50 strings = SI$0.18.

Chapter: 19
MARKETING

19.1 Table 19.1 presents a summary of marketing data collected in the survey, listing crops marketed against the number of observation recorded. The mean weight marketed is recorded, the time taken to go to market and back, the number of times the commodity is marketed per year, and the number of people involved in marketing. These are grouped under the heading of "marketing" details.

19.2 Marketing costs are recorded under the headings of freight or transport costs, fares for people involved in marketing, and market tax which may be imposed at the point of sale.

19.3 Revenues are possible where wages are earned, for instance from selling other farmers' produce and from the sale of crops. It is often difficult for sellers to specify costs and revenues, and in such cases data have to be treated as "missing". Thus the number of observations for crop sales may be lower than those for marketing data.

19.4 Table 19.2 is a transformation of the raw marketing data into an "average" annual marketing budget. The data are incomplete because of difficulties in recalling weights sold and marketing revenues. It is presented not as a model marketing budget, but as a data set to provide as much information on marketing as possible, albeit with gaps.

19.5 The two right-most columns show the net marketing revenue by crop and by household. The "net marketing revenue by crop" is the net return from sales after deducting costs. It is not the average income from crop sales since revenue may be negative where income data are missing or as a result of the double counting of transport costs when freight expenses are shared among several crops.

19.6 The "net marketing revenue per household" is the average household earnings taking account of the proportion of households selling each type of crop, but based on the limitations of the crop revenue data.

Table: 19.1
MARKETING TIME AND CROP PRICES

Basic Marketing Data:		marketing: number of obs	marketing: mean weight marketed	marketing: time to market and back	marketing: times marketed per year	marketing: number of people	costs: freight/ transport cost	costs: fares for people	costs: market tax	revenues: wages earned	revenues: crop sale price	revenues: crop sale obs
		(obs)	(kg)	(days)	(times)	(people)	(SI$)	(SI$)	(SI$)	(SI$)	($/kg)	(obs)
ALL CROPS	Average	28	118	1.5	5	1	4.33	2.50		0.25	0.36	28
COCONUT	Copra	12	258	2.6	3	1	10.11	4.83		0.50	0.33	12
ROOT CROPS	Sweet Potato	7	18	0.9	4	2		1.71		0.14	0.21	7
	Cassava	1	7	1.0	20	2					0.12	1
BANANA	Sweet banana	2	31	0.3	16	1					0.18	2
NUT TREES	Betel Nut	6	3	0.6	6	2					0.38	6
Number of households		40										

Table: 19.2
INCOME FROM MARKETING

Annual Marketing Budget:

					costs (SI$)				revenues (SI$)				
		% houses marketing crop (%)	weight marketed (kg)	work days (days)	freight/ transport cost (SI$)	fares for people (SI$)	market tax (SI$)	total marketing costs (SI$)	wages earned (SI$)	crop sales (SI$)	total revenue (SI$)	net marketing revenue by crop (SI$)	net marketing revenue per household (SI$)
ALL CROPS	Average		621	10.5	23	13		35.87	1	225.72	227.03	191	58
COCONUT	Coconut	30	687	8.0	27	13		39.84	1	226.79	228.12	188	56
ROOT CROPS	Sweet Potato	18	66	5.2		6		6.12	1	13.60	14.11	8	1
	Cassava	3	140	40.0						16.80	16.80	17	
BANANA	Sweet banana	5	496	2.0						90.02	90.02	90	
NUT TREES	Betel Nut	15	21	5.5						7.84	7.84	8	

19.7 Local market prices recorded in Manuopo in May 1988 are as follows:

crop	price $.c	weight kg	price/kg $/kg
Dry coconut	0.10	0.60	0.17
Green coconut	0.10	0.70	0.14
Sweet potato	2.00	8.00	0.25
Cooking banana	0.10	1.71	0.06
Sweet banana	0.30	1.50	0.20
Snake bean	0.10	0.80	0.13
Shallot	0.10	0.10	1.00
Sugar cane	0.10	1.20	0.08
Betel nut	0.20	0.50	0.40

19.8 Table 19.3 shows the time taken to different markets and the type of crop sold at each market. The classification of markets is subject to local interpretation, where "central" would generally be the provincial capital.

Table: 19.3
MARKET LOCATION

market location:	local	inter-mediate	central	Honiara	% obs	number of obs
i) Time taken to market produce						
time taken to go to market and back (days)	(% observations)					
0 - .5	21	29			50	14
.5 - 1	25	7			32	9
1 - 2						
2 - 5		4			4	1
5 - 10			14		14	4
> 10						
% observations	46	39	14		100	
number of observations	13	11	4			28
mean time (days)	0.75	0.80	1.11	6.30		1.75

ii) Crops sold at different markets (% observations)

COCONUT	copra	14	14	14	43	12
ROOT CROPS	sweet potato	11	14		25	7
	cassava	4			4	1
FRUIT CROPS	sweet banana	4	4		7	2
NUT TREES	betel nut	14	7		21	6
		46	39	14	100	
		13	11	4		28

19.9 Table 19.4 summarises crop price perception and sale volumes.

Table: 19.4
CROP PRICE PERCEPTION AND SALE VOLUMES

		(---- sale price ----) poor	average	good	(----- sale volume -----) little	average	more than usual	number of obs
COCONUT	Copra	67	33		67	25	8	12
ROOT CROPS	Sweet Potato	57	43		57	43		7
	Cassava	100			100			1
FRUIT CROPS	Sweet Banana	100					100	2
NUT TREES	Betel Nut	67	33		67	17	17	6
Number of observations		19	9		17	7	4	28

19.10 Generally prices are regarded as poor and crop sales are low. Much of the marketing takes place locally.

19.11 Table 19.5 summarises marketing problems. To the right of the table are the proportion of cases by severity of problem. These are combined with crop type in the body of the table to show the "index of severity". In this index "no problem" is weighted "0", "slight problem" is weighted "0.5", and "severe problem" is weighted "1.0". Thus if all cases registered a severe problem the index would be "1.0".

Table: 19.5
MARKETING PROBLEMS

Number of observations = 28

	⟨--- crop type ---⟩			⟨--- severity of problem ---⟩		
	coconut and cocoa	root crops	other crops	none	slight	severe
	(index of severity)			(% cases)		
terrain too difficult		0.1	0.1	75	25	
distance too great	0.2	0.1	0.1	46	39	14
not enough time/labour	0.0	0.1	0.0	75	25	
transport cost too high	0.1	0.0		82	4	14
low price at market	0.4	0.2	0.2	4	46	50
lack of transport	0.2	0.1	0.0	50	36	14
unreliable transport	0.1	0.1	0.0	71	11	18
risk of not selling enough	0.1	0.0	0.0	75	18	7
crop damage in transit	0.0	0.0		93	4	4
administrative restrictions		0.0		96	4	
quarantine control				100		
other problem				100		

Note: "Index of Severity is a weighted summary of severity of marketing problems.
It falls in the range 0 to 1 where 0.0 = no marketing problem
0.5 = slight marketing problem
1.0 = severe marketing problem

19.12 The dominant problem is poor prices, followed by transport problems.

Annex: 1
CROP NAMES AND CODES

A1.1 The following list describes the hierarchical coding sequence used by AES in farming systems surveys to describe crop types. The list may be added to by inserting other crops of interest within the appropriate category.

A1.2 At the garden level only broad distinctions are made between cleared land, tree crops, short term cash crops, and food crops. Only single digit numeric codes are permitted at this level and these do not distinguish between crop type or mixtures. They do, however, provide important information about the structure of the holding. Code "1" for instance specifies "tree crops".

A1.3 At the plot level alphabetical codes are used to describe crop mixtures. These are used to describe cropping patterns and the analysis of labour by crop. Letter codes are strung together so there is no pre-set limit on the complexity of mixtures described. Some simplification is introduced within the code categories themselves. The dominant crop is listed first and other crops are listed to the right in decreasing order of importance. The string code then takes the form of an alphabetical "number", where the most significant characters are to the left and the least significant to the right. Forinstance "a" specifies "cleared land", while "rvgfl" specifies a mixture in decreasing order of importance of "sweet potato, cassava, cabbage, beans, banana".

A1.4 At the yield and marketing levels it is necessary to specify exactly the crop under study, and so a unique three-digit numeric code is assigned to each crop. The list need not be complete and may be added to as necessary since "spare codes" are available. Forinstance "613" specifies "pineapple".

Table: A1.1
CROP NAMES AND CODES

garden		plot	yield and marketing		scientific name
code	name	code	code	name	
0	cleared	a	100	CLEARED (unplanted)	
1	tree crops	b	200	COCONUT	Cocos nucifera
			210	Local Tall	
			211	Rennel	
			212	Dwarf Hybrid	
			219	Other	
			250	Copra	
1	tree crops	c	300	COCOA	Theobroma cacao
			310	Cocoa green beans	
			311	Cocoa dry beans	
		d		Pasture	
3	food crops		400	ROOT CROPS	
		r	410	Sweet Potato	Ipomoea batatas
		s	411	Taro Common	Colocasia esculenta
		s	412	Giant	Alocasia micorhiza
		s	413	Hong Kong	Xanthosoma saggitifolium
		s	414	Swamp	Cytosperma chamissonis
		t	415	Yam	Dioscorea alata
		u	416	Pana	Dioscorea esculenta
		v	417	Cassava	Manihot esculenta
		w	419	Other root crop	
3	food crops	e	430	GRAIN CROPS	
			431	Corn	Zea mays
			432	Peanuts	Arachis hypogaea
			439	Other grain crop	
3	food crops	f	440	BEANS	
			441	Long bean	Phaseolus vulgaris
			442	Wing bean	Psophocarpus tetragonolobus
			443	Snake bean	Trichosanthes cucumerina
			444	Mung bean	Phaseolus aureus
			445	Pigeon pea	Cajanus cajan
			449	Other bean	

3	food crops	g	450	CABBAGE	
			451	Hibiscus cabbage	Hibiscus manihot
			452	Kangkong	
			453	Chinese cabbage	Brassica chinensis
			454	English cabbage	Brassica compestis
			455	Watercress	
			459	Other cabbage	
3	food crops	h	460	VEGETABLE	
			461	Pumpkin	Cucurbita maxima
			462	Cucumber	Cucumis sativus
			463	Shallot	Allium spp.
			464	Onion	Allium cepa
			465	Tomato	Lycopersicon esculentum
			466	Okra	Hibiscus esculentus
			467	Egg plant	Solanum melongena
			468	Green pepper (sweet)	Capsicum annuum
			479	Other vegetable	
2	short term cash crops	i	500	SPICES	
			511	Chilli pepper	Capsicum spp.
			512	Pepper corn	Piper nigrum
			513	Turmeric	Curcuma domestica
			514	Cardamom	Ellettaria cardamomum
			515	Cinnamon	Cinnamomum zeylanicum
			516	Ginger	Zingiber officinale
			517	Garlic	Allium sativum
			518	Vanilla	Vanilla fragrans
			529	Other spice	
2/3	cash/food crops	j	600	FRUIT CROPS	
			611	Water melon	Citrullus lanatus
			612	Rock melon	
			613	Pineapple	Ananas comosus
			614	Paw Paw	Carica papaya
			615	Passion fruit	Passiflora edulus f. flavicarpa
			619	Other fruit crop	
1	tree crops	k	620	FRUIT TREES	
			621	Guava	Psidium guajava
			622	Mango	Mangifera indica
			623	Soursop	
			624	Local Apple	
			625	Malayan Apple	Eugenia malaccensis
			626	Avocado	Persea americana
			629	Other fruit tree	

3	food crops	l	630	BANANA	*Musa spp.*
			631	Cooking banana	
			632	Sweet banana	
			639	Other banana	
1	tree crops	m	640	CITRUS TREES	
			641	Orange	*Citrus sinensis*
			642	Lime	*Citrus aurantifolia*
			643	Grapefruit	*Citrus paradisi*
			644	Pomelo	*Citrus grandis*
			649	Other citrus	
1	tree crops	n	650	NUT TREES	
			651	Ngali Nut	*Canarium spp.*
			652	Cut Nut	*Barringtonia spp.*
			653	Betel Nut	*Areca catechu*
			654	Cashew Nut	*Anacardium occidentale*
			655	Alite Nut	*Terminalia catappa*
			659	Other Nut	
2	short term cash crops	o	660	SUGAR CANE	
			661	Sugar cane	*Saccharum spp.*
			662	Pit Pit	*Saccharum edule*
			669	Other	
1	tree crops	p	700	FOOD/BUILDING TREE	
			701	Breadfruit	*Artocarpus altilis*
			702	Sago palm	*Metroxylon spp.*
			703	Bamboo	*Nastus spp.*
			709	Other tree	
2	short term cash crops	q	800	Tobacco	*Nicotiana tabacum*

Annex: 2
LABOUR BUDGETS

A2.1 Sunmmaries of labour in the main body of the report are derived from labour budgets shown in tables A2.1 to A2.9, each covering a major land or crop operation:

Table	Operation
A2.1	Land Clearance
A2.2	Cultivation
A2.3	Planting
A2.4	Tree Crops Establishment
A2.5	Tree Crops Maintenance
A2.6	First Weeding
A2.7	Second Weeding
A2.8	Third Weeding
A2.9	Harvesting

A2.2 Each table is divided into two sub-tables, named "a" and "b". Part "a" expresses budgets in the form of labour per hectare. Part "b" converts these results to labour per holding, based on mean holding sizes previously derived.

A2.3 Tables in "part a" are divided into two main components. Part "i" expresses "labour input by main crop growing in the plot". This is the measured labour input from field data and is derived from a subsample of plot observations. To the left of the table is the main crop type, which is the dominant crop in a mixture. In the first column of the table is the number of plots on which observations were made, and in the second column is the mean area of observed plots. The third column summarises the average number of times per year that the operation is performed in a cropping sequence, and the fourth column expresses the average number of hours worked per day.

A2.4 Within the box are labour data expressed in terms of seasonal (single crop) and annual (crop sequence) labour input, broken down by men, women and paid labour. The wage cost of paid labour is shown in the right-most column. In this, hours are converted to days by dividing by the average number of hours worked per day. This then takes account of "unproductive" time such as for travel to and from the garden, and expresses labour in terms of actual time taken. It does not, however, take account of different agricultural operations which may take place on the same day for instance where a morning might be spent clearing a plot while the afternoon is spent in weeding. Commonly work is split between the cool hours of the morning and late afternoon and so such circumstances should not generally arise.

A2.5 Below is "part ii" of the table, in which the composition of labour input is shown in more detail. The first four columns show the average number of workers in each category. Within the box is a summary of the table above, in which the % contribution of men, women and paid labour is shown.

A2.6 "Part b" of the table is on the page following "part a", in which annual labour per hectare is converted to annual labour per holding based on mean holding areas recorded for each given crop and operation - since each sub-sample will differ from the others. These are shown in the upper part of the table in two forms, as work hours and as work days by category of labour. The annual wage labour cost is shown in the far right column of the table.

A2.7 Below is the labour budget expressed in terms of time per household labour unit. In this it is assumed that communal labour is reciprocated and so balances out. Total labour input may therefore be expressed simply in terms of family labour. Wage labour is external and is therefore given the adult equivalent "weighting" of 1. Family labour is weighted according to the age composition of the family, analysed in chapter 3.

A2.8 Each set of tables for an operation is accompanied by a diagram in which the annual days of labour per holding are summarised by crop and by labour category.

A2.9 Various points should be noted about the derivation of labour budgets:

i) They are expressed in the form of "models" which are based on a sub-sample of observations. These are derived from interview, not direct measurement, although care is taken to minimise recall periods. Labour budgets are built up from a mosaic of labour records.

ii) Crop categories are summaries of complex mixtures in which the crop listed is dominant. Labour data are thus compatible with cropping pattern data and represents actual field conditions. No attempt is made to restrict or control the conditions under observation.

iii) Each table shows the labour input for an operation which is conducted. The tables do not show the extent to which operations may be missed or combined. Such refinements are difficult to include without a more complex, and therefore more costly and time consuming, survey design. The analysis therefore tends to be conservative since it does not take account of possible economies in combined operations.

iv) Caution should be exercised in interpreting results from few observations since labour data on complex systems are very variable.

v) Labour, although of central importance in the agricultural economy, is not necessarily economically optimising. Often labour has an important social character in which households will group together and "share" labour. Differences in site and labour composition, together with the social character of some labour, introduce considerable variability into results.

Table: A2.1a
LABOUR OPERATIONS ON LAND CLEARANCE (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season: hours/ha: men	labour input: per season: hours/ha: women	labour input: per season: hours/ha: paid	labour input: per year: hours (hrs/ha)	labour input: per year: days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	82	0.133	1.12	5.4	646	200	12	963	179	1.70
Cleared land :	2	0.092	1.00	5.5	441			441	80	
Coconut :	10	0.329	1.00	5.5	109			109	20	
Fruit trees :	2	0.571	1.00	4.0	52			52	13	
Nut trees :	2	0.560	1.00	1.5	26			26	17	
Sugar cane :	1	0.007	1.00	6.0	811	1622		2432	405	
Food/building tree :	2	1.056	1.00	2.0	135			135	67	
Sweet potato :	36	0.052	1.28	5.5	523	151	7	870	157	1.87
Pana :	26	0.041	1.00	5.8	1183	361	28	1571	271	2.78
Cassava :	1	0.105	1.00	4.0	191			191	48	

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	1.6	0.3	0.5	2.3	75	23	1
Cleared land :	3.0			3.0	100		
Coconut :	1.3			1.3	100		
Fruit trees :	1.0			1.0	100		
Nut trees :	1.0			1.0	100		
Sugar cane :	1.0	1.0		2.0	33	67	
Food/building tree :	1.0			1.0	100		
Sweet potato :	1.7	0.4	0.6	2.6	77	22	1
Pana :	1.6	0.3	0.8	2.6	75	23	2
Cassava :	1.0			1.0	100		

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

Table: A2.1b
LABOUR OPERATIONS ON LAND CLEARANCE (per holding)

i) Total time worked

		mean holding area (ha)	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	work days: total	labour cost (SI$)
Total	:	0.429	144	33	2	26	6	0	33	0
Cleared land	:	0.005	2			0			0	
Coconut	:	0.244	27			5			5	
Fruit trees	:	0.004	0			0			0	
Nut trees	:	0.021	1			0			0	
Sugar cane	:									
Food/building tree	:	0.010	1			1			1	
Sweet potato	:	0.098	66	19	1	12	3	0	15	0
Pana	:	0.040	47	14	1	8	2	0	11	0
Cassava	:	0.003	1			0			0	
Other		0.004								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	% contribution to family labour: men	% contribution to family labour: women
Labour units available	2.49	1.99	1.00					
Total	58	17	2	11	3	0	81	19
Cleared land	1			0			100	
Coconut	11			2			100	
Fruit trees	0			0			100	
Nut trees	0			0			100	
Sugar cane								
Food/building tree	1			0			100	
Sweet potato	26	9	1	5	2	0	78	22
Pana	19	7	1	3	1	0	77	23
Cassava	0			0			100	

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.2a
LABOUR OPERATIONS ON CULTIVATION (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season: men (hours/ha)	labour input: per season: women (hours/ha)	labour input: per season: paid (hours/ha)	labour input: per year: hours (hrs/ha)	labour input: per year: days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	81	0.125	1.36	4.7	514	229	10	1022	220	1.80
Cleared land :										
Coconut :	10	0.329	1.00	4.3	65			65	15	
Fruit trees :	2	0.571	1.00	2.0	65			65	33	
Nut trees :	1	0.400	1.00	2.0	100			100	50	
Sugar cane :	1	0.007	1.00	3.0	405	405		811	270	
Food/building tree :	2	1.056	1.00	1.5	86			86	58	
Sweet potato :	38	0.052	1.71	5.1	327	168		846	167	
Pana :	26	0.041	1.08	4.8	1061	453	31	1663	346	5.62
Cassava :	1	0.105	1.00	4.0	153			153	38	

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	1.6	0.6	0.5	2.7	68	30	1
Cleared land :							
Coconut :	1.3			1.3	100		
Fruit trees :	1.0			1.0	100		
Nut trees :	1.0			1.0	100		
Sugar cane :	1.0	1.0		2.0	50	50	
Food/building tree :	1.0			1.0	100		
Sweet potato :	1.3	0.6		1.9	66	34	
Pana :	2.3	0.9	1.6	4.8	69	29	2
Cassava :	1.0			1.0	100		

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

Table: A2.2b
LABOUR OPERATIONS ON CULTIVATION (per holding)

i) Total time worked

	mean holding area (ha)	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	work days total	labour cost (SI$)
Total :	0.429	120	48	1	26	10	0	36	0
Cleared land :	0.005								
Coconut :	0.244	16			4			4	
Fruit trees :	0.004	0			0			0	
Nut trees :	0.021	2			1			1	
Sugar cane :									
Food/building tree :	0.010	1			1			1	
Sweet potato :	0.098	55	28		11	6		16	
Pana :	0.040	46	20	1	10	4	0	14	0
Cassava :	0.003	0			0			0	
Other	0.004								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	% contribution to family labour men	% contribution to family labour women
Labour units available	2.49	1.99	1.00					
Total	48	24	1	10	5	0	72	28
Cleared land								
Coconut	6			1			100	
Fruit trees	0			0			100	
Nut trees	1			0			100	
Sugar cane								
Food/building tree	0			0			100	
Sweet potato	22	14		4	3		66	34
Pana	18	10	1	4	2	0	70	30
Cassava	0			0			100	

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.3a
LABOUR OPERATIONS ON PLANTING (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: men (hours/ha)	labour input: women (hours/ha)	labour input: paid (hours/ha)	labour input: hours per year (hrs/ha)	labour input: days per year (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	82	0.132	1.38	4.7	309	333		884	187	
Cleared land :										
Coconut :	10	0.329	1.00	4.5	65			65	14	
Fruit trees :	2	0.571	1.00	2.0	65			65	33	
Nut trees :	2	0.560	1.00	1.5	51			51	34	
Sugar cane :	1	0.007	1.00	3.0	405	405		811	270	
Food/building tree :	2	1.056	1.00	1.5	86			86	58	
Sweet potato :	38	0.052	1.76	4.9	262	206		825	167	
Pana :	26	0.041	1.08	5.3	529	733		1360	256	
Cassava :	1	0.105	1.00	4.0	153			153	38	

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	1.1	0.9		2.0	48	52	
Cleared land :							
Coconut :	1.3			1.3	100		
Fruit trees :	1.0			1.0	100		
Nut trees :	1.0			1.0	100		
Sugar cane :	1.0	1.0		2.0	50	50	
Food/building tree :	1.0			1.0	100		
Sweet potato :	1.1	0.8		1.8	56	44	
Pana :	1.2	1.5		2.7	42	58	
Cassava :	1.0			1.0	100		

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

Table: A2.3b
LABOUR OPERATIONS ON PLANTING (per holding)

i) Total time worked

	mean holding area (ha)	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	work days total	labour cost (SI$)
Total :	0.429	87	67		18	13		32	
Cleared land :	0.005								
Coconut :	0.244	16			3			3	
Fruit trees :	0.004	0			0			0	
Nut trees :	0.021	1			1			1	
Sugar cane :									
Food/building tree :	0.010	1			1			1	
Sweet potato :	0.098	45	36		9	7		16	
Pana :	0.040	23	32		4	6		10	
Cassava :	0.003	0			0			0	
Other	0.004								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	% contribution to family labqur men	% contribution to family labqur women
Labour units available	2.49	1.99	1.00					
Total	35	34		7	7		56	44
Cleared land								
Coconut	6			1			100	
Fruit trees	0			0			100	
Nut trees	0			0			100	
Sugar cane								
Food/building tree	0			0			100	
Sweet potato	18	18		4	4		56	44
Pana	9	16		2	3		42	58
Cassava	0			0			100	

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.4a
LABOUR OPERATIONS ON ESTABLISHMENT (per hectare)

i) Labour input by main crop growing in the plot

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: men (hours/ha)	labour input: women (hours/ha)	labour input: paid (hours/ha)	labour input: hours per year (hrs/ha)	labour input: days per year (d/ha)	labour cost ($/ha/yr)
All plots summary	9	0.577	1.11	2.1	17			19	9	
Cleared land										
Coconut	2	0.375	1.00	2.0	6			6	3	
Fruit trees	2	0.571	1.50	2.0	26			39	20	
Nut trees	2	0.560	1.00	1.5	6			6	4	
Sugar cane										
Food/building tree	2	1.056	1.00	3.5	25			25	7	
Sweet potato	1	0.071	1.00	1.0	28			28	28	
Pana										
Cassava										

ii) Labour composition

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
All plots summary	1.0			1.0	100		
Cleared land							
Coconut	1.0			1.0	100		
Fruit trees	1.0			1.0	100		
Nut trees	1.0			1.0	100		
Sugar cane							
Food/building tree	1.0			1.0	100		
Sweet potato	1.0			1.0	100		
Pana							
Cassava							

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

Table: A2.4b
LABOUR OPERATIONS ON ESTABLISHMENT (per holding)

i) Total time worked

	mean holding area (ha)	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	work days total	labour cost (I)
Total :	0.429	5			4			4	
Cleared land :	0.005								
Coconut :	0.244	2			1			1	
Fruit trees :	0.004	0			0			0	
Nut trees :	0.021	0			0			0	
Sugar cane :									
Food/building tree :	0.010	0			0			0	
Sweet potato :	0.098	3			3			3	
Pana :	0.040								
Cassava :	0.003								
Other	0.004								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	% contribution to family labour men	% contribution to family labour women
Labour units available	2.49	1.99	1.00					
Total	2			2			100	
Cleared land								
Coconut	1			0			100	
Fruit trees	0			0			100	
Nut trees	0			0			100	
Sugar cane								
Food/building tree	0			0			100	
Sweet potato	1			1			100	
Pana								
Cassava								

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.5a
LABOUR OPERATIONS ON MAINTENANCE (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season: hours/ha: men	labour input: per season: hours/ha: women	labour input: per season: hours/ha: paid	labour input: per year: hours (hrs/ha)	labour input: per year: days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	7	0.747	1.14	2.3	19	0		22	10	
Cleared land :										
Coconut :	1	0.856	1.00	1.0	11			11	11	
Fruit trees :	2	0.571	1.50	3.5	40			60	17	
Nut trees :	2	0.560	1.00	1.5	6	1		6	4	
Sugar cane :										
Food/building tree :	2	1.056	1.00	2.5	16			16	6	
Sweet potato :										
Pana :										
Cassava :										

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	1.3	0.1		1.4	99	1	
Cleared land :							
Coconut :	3.0			3.0	100		
Fruit trees :	1.0			1.0	100		
Nut trees :	1.0	0.5		1.5	89	11	
Sugar cane :							
Food/building tree :	1.0			1.0	100		
Sweet potato :							
Pana :							
Cassava :							

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

Table: A2.5b
LABOUR OPERATIONS ON MAINTENANCE (per holding)

i) Total time worked

	mean holding area (ha)	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	work days: total	labour cost (SI$)
Total :	0.429	3	0		3	0		3	
Cleared land :	0.005								
Coconut :	0.244	3			3			3	
Fruit trees :	0.004	0			0			0	
Nut trees :	0.021	0	0		0	0		0	
Sugar cane :									
Food/building tree :	0.010	0			0			0	
Sweet potato :	0.098								
Pana :	0.040								
Cassava :	0.003								
Other	0.004								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	% contribution to family labour: men	% contribution to family labour: women
Labour units available	2.49	1.99	1.00					
Total	1	0		1	0		100	0
Cleared land								
Coconut	1			1			100	
Fruit trees	0			0			100	
Nut trees	0	0		0	0		89	11
Sugar cane								
Food/building tree	0			0			100	
Sweet potato								
Pana								
Cassava								

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.6a
LABOUR OPERATIONS ON FIRST WEEDING (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: men (hours/ha)	labour input: women (hours/ha)	labour input: paid (hours/ha)	labour input: hours per year (hrs/ha)	labour input: days per year (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	78	0.131	1.41	4.5	116	269		542	122	
Cleared land :										
Coconut :	10	0.391	1.00	4.0	51			51	13	
Fruit trees :	2	0.571	1.00	3.0	60			60	20	
Nut trees :										
Sugar cane :	1	0.007	1.00	1.0	135	135		270	270	
Food/building tree :	2	1.056	1.00	2.5	18			18	7	
Sweet potato :	38	0.053	1.79	4.7	173	287		823	174	
Pana :	24	0.040	1.08	4.5	62	408		509	113	
Cassava :	1	0.105	1.00	8.0	153	153		306	38	

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	0.7	1.2		1.9	30	70	
Cleared land :							
Coconut :	1.5			1.5	100		
Fruit trees :	1.0			1.0	100		
Nut trees :							
Sugar cane :	1.0	1.0		2.0	50	50	
Food/building tree :	1.0			1.0	100		
Sweet potato :	0.7	1.4		2.1	38	62	
Pana :	0.3	1.5		1.8	13	87	
Cassava :	1.0	1.0		2.0	50	50	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

Table: A2.6b
LABOUR OPERATIONS ON FIRST WEEDING (per holding)

i) Total time worked

	mean holding area (ha)	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	work days total	labour cost (I)
Total :	0.429	46	68		10	15		25	
Cleared land :	0.005								
Coconut :	0.244	12			3			3	
Fruit trees :	0.004	0			0			0	
Nut trees :	0.021								
Sugar cane :									
Food/building tree :	0.010	0			0			0	
Sweet potato :	0.098	30	50		6	11		17	
Pana :	0.040	3	18		1	4		5	
Cassava :	0.003	0	0		0	0		0	
Other	0.004								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	% contribution to family labour men	% contribution to family labour women
Labour units available	2.49	1.99	1.00					
Total	19	34		4	7		40	60
Cleared land								
Coconut	5			1			100	
Fruit trees	0			0			100	
Nut trees								
Sugar cane								
Food/building tree	0			0			100	
Sweet potato	12	25		3	5		38	62
Pana	1	9		0	2		13	87
Cassava	0	0		0	0		50	50

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.7a
LABOUR OPERATIONS ON SECOND WEEDING (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season: hours/ha: men	labour input: per season: hours/ha: women	labour input: per season: hours/ha: paid	labour input: per year: hours (hrs/ha)	labour input: per year: days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	51	0.113	1.59	4.2	99	273		591	141	
Cleared land :										
Coconut :	4	0.330	1.00	2.8	55			55	20	
Fruit trees :	1	0.142	1.00	3.0	84			84	28	
Nut trees :										
Sugar cane :	1	0.007	1.00	1.0	135	135		270	270	
Food/building tree :	2	1.056	1.00	2.5	18			18	7	
Sweet potato :	31	0.053	1.94	4.2	113	209		624	149	
Pana :	11	0.039	1.09	5.0	84	648		799	160	
Cassava :	1	0.105	1.00	8.0	153	153		306	38	

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	0.6	1.2		1.9	27	73	
Cleared land :							
Coconut :	1.8			1.8	100		
Fruit trees :	1.0			1.0	100		
Nut trees :							
Sugar cane :	1.0	1.0		2.0	50	50	
Food/building tree :	1.0			1.0	100		
Sweet potato :	0.5	1.4		1.9	35	65	
Pana :	0.3	1.7		2.0	12	88	
Cassava :	1.0	1.0		2.0	50	50	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

Table: A2.7b
LABOUR OPERATIONS ON SECOND WEEDING (per holding)

i) Total time worked

	mean holding area (ha)	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	work days total	labour cost (SI$)
Total :	0.429	40	68		11	15		26	
Cleared land :	0.005								
Coconut :	0.244	14			5			5	
Fruit trees :	0.004	0			0			0	
Nut trees :	0.021								
Sugar cane :									
Food/building tree :	0.010	0			0			0	
Sweet potato :	0.098	21	40		5	9		15	
Pana :	0.040	4	28		1	6		6	
Cassava :	0.003	0	0		0	0		0	
Other	0.004								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	% contribution to family labour men	% contribution to family labour women
Labour units available	2.49	1.99	1.00					
Total	16	34		4	8		37	63
Cleared land								
Coconut	5			2			100	
Fruit trees	0			0			100	
Nut trees								
Sugar cane								
Food/building tree	0			0			100	
Sweet potato	9	20		2	5		35	65
Pana	1	14		0	3		12	88
Cassava	0	0		0	0		50	50

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.8a
LABOUR OPERATIONS ON THIRD WEEDING (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: men (hours/ha)	labour input: women (hours/ha)	labour input: paid (hours/ha)	labour input: hours per year (hrs/ha)	labour input: days per year (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	8	0.183	1.50	2.8	48	43		137	50	
Cleared land :										
Coconut :	2	0.586	1.00	4.0	27			27	7	
Fruit trees :										
Nut trees :										
Sugar cane :	1	0.007	1.00	1.0	135	135		270	270	
Food/building tree :	1	0.112	1.00	3.0	27			27	9	
Sweet potato :	4	0.044	2.00	2.5	42	52		189	76	
Pana :										
Cassava :										

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	1.1	0.5		1.6	53	47	
Cleared land :							
Coconut :	2.0			2.0	100		
Fruit trees :							
Nut trees :							
Sugar cane :	1.0	1.0		2.0	50	50	
Food/building tree :	1.0			1.0	100		
Sweet potato :	0.8	0.8		1.5	45	55	
Pana :							
Cassava :							

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

Table: A2.8b
LABOUR OPERATIONS ON THIRD WEEDING (per holding)

i) Total time worked

		mean holding area (ha)	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	work days: total	labour cost (SI$)
Total	:	0.429	15	10		5	4		9	
Cleared land	:	0.005								
Coconut	:	0.244	7			2			2	
Fruit trees	:	0.004								
Nut trees	:	0.021								
Sugar cane	:									
Food/building tree	:	0.010	0			0			0	
Sweet potato	:	0.098	8	10		3	4		7	
Pana	:	0.040								
Cassava	:	0.003								
Other		0.004								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	% contribution to family labour: men	% contribution to family labour: women
Labour units available	2.49	1.99	1.00					
Total	6	5		2	2		60	40
Cleared land								
Coconut	3			1			100	
Fruit trees								
Nut trees								
Sugar cane								
Food/building tree	0			0			100	
Sweet potato	3	5		1	2		45	55
Pana								
Cassava								

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.9a
LABOUR OPERATIONS ON HARVESTING (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season: hours/ha: men	labour input: per season: hours/ha: women	labour input: per season: hours/ha: paid	labour input: per year: hours (hrs/ha)	labour input: per year: days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	75	0.137	1.63	2.0	283	1247	0	2489	1253	0.32
Cleared land :										
Coconut :	10	0.375	2.10	3.9	202	76		584	150	
Fruit trees :	1	1.000	2.00	3.0			15	30	10	7.50
Nut trees :	1	0.400	3.00	3.0			13	38	13	6.25
Sugar cane :	1	0.007	1.00	1.0	5405	5405		10811	10811	
Food/building tree :	2	1.056	2.00	3.5	57	131	3	383	109	5.00
Sweet potato :	37	0.053	1.76	1.8	132	1439		2758	1547	
Pana :	22	0.043	1.14	1.7	400	1526		2189	1267	
Cassava :	1	0.105	1.00	1.0		306		306	306	

Note: The "average hours worked per day" for fruit trees and nut trees is unknown, and all labour is hired.
A nominal value of 3.0 hours worked per day is assumed.

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	0.6	1.5	0.2	2.3	18	81	0
Cleared land :							
Coconut :	2.5	1.3		3.8	73	27	
Fruit trees :			5.0	5.0			100
Nut trees :			5.0	5.0			100
Sugar cane :	1.0	1.0		2.0	50	50	
Food/building tree :	1.0	4.0	1.5	6.5	30	68	2
Sweet potato :	0.2	1.5		1.7	8	92	
Pana :	0.5	1.7		2.1	21	79	
Cassava :		1.0		1.0		100	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

Table: A2.9b
LABOUR OPERATIONS ON HARVESTING (per holding)

i) Total time worked

		mean holding area (ha)	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	work days: total	labour cost (I)
Total	:	0.429	146	359	1	50	191	0	241	0
Cleared land	:	0.005								
Coconut	:	0.244	104	39		27	10		37	
Fruit trees	:	0.004			0			0	0	0
Nut trees	:	0.021			1			0	0	0
Sugar cane	:									
Food/building tree	:	0.010	1	3	0	0	1	0	1	0
Sweet potato	:	0.098	23	248		13	139		152	
Pana	:	0.040	18	69		11	40		51	
Cassava	:	0.003		1			1		1	
Other		0.004								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	% contribution to family labour: men	% contribution to family labour: women
Labour units available	2.49	1.99	1.00					
Total	58	181	1	20	96	0	29	71
Cleared land								
Coconut	42	20		11	5		73	27
Fruit trees			0			0		
Nut trees			1			0		
Sugar cane								
Food/building tree	0	1	0	0	0	0	31	69
Sweet potato	9	124		5	70		8	92
Pana	7	35		4	20		21	79
Cassava		0			0			100

Derived from household composition labour availability
% contribution to family labour is derived from the table above

LAND CLEARANCE
Annual Labour per Holding

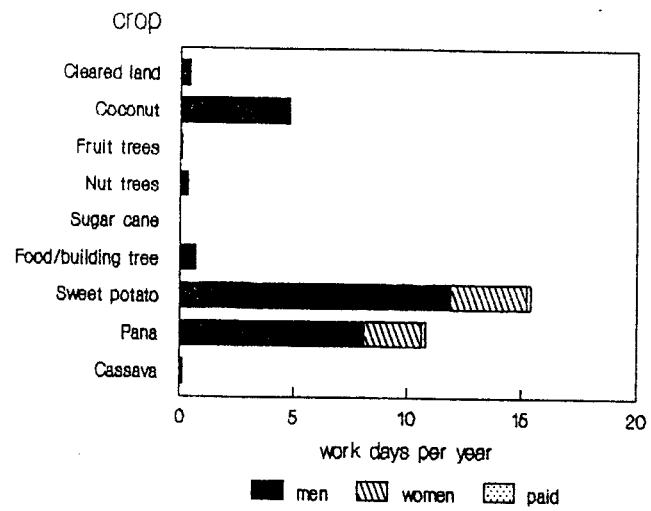


Diagram: A2.1

CULTIVATION
Annual Labour per Holding

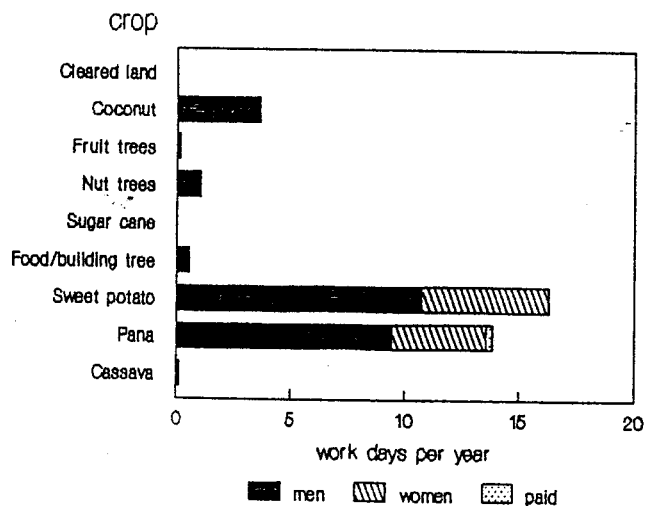


Diagram: A2.2

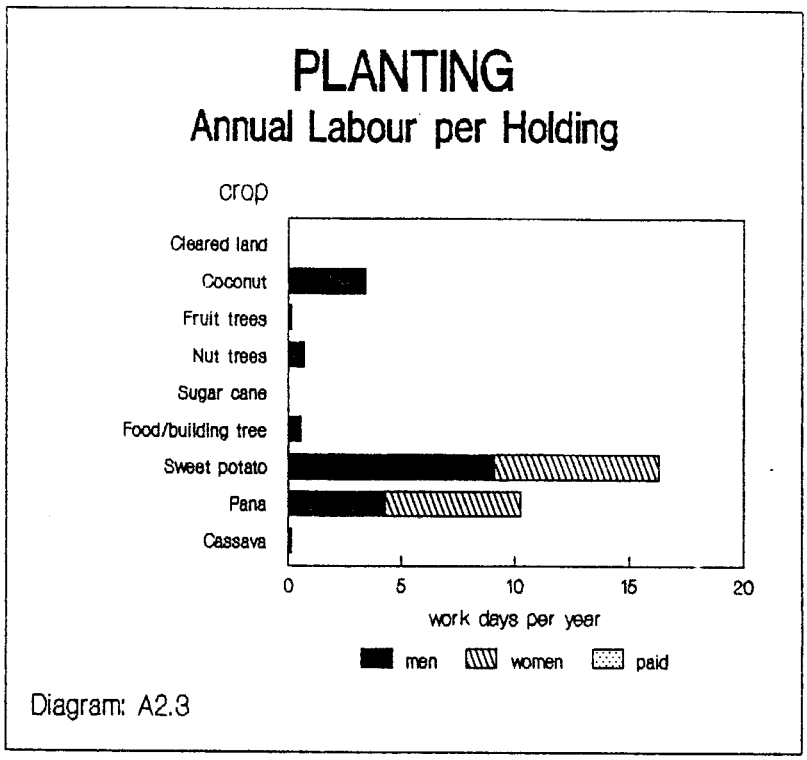


Diagram: A2.3

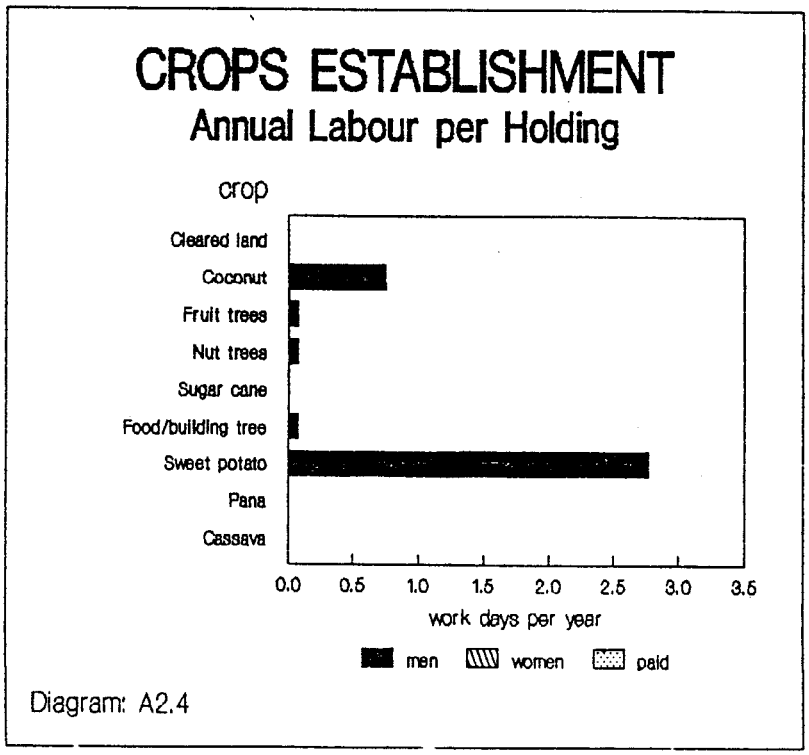


Diagram: A2.4

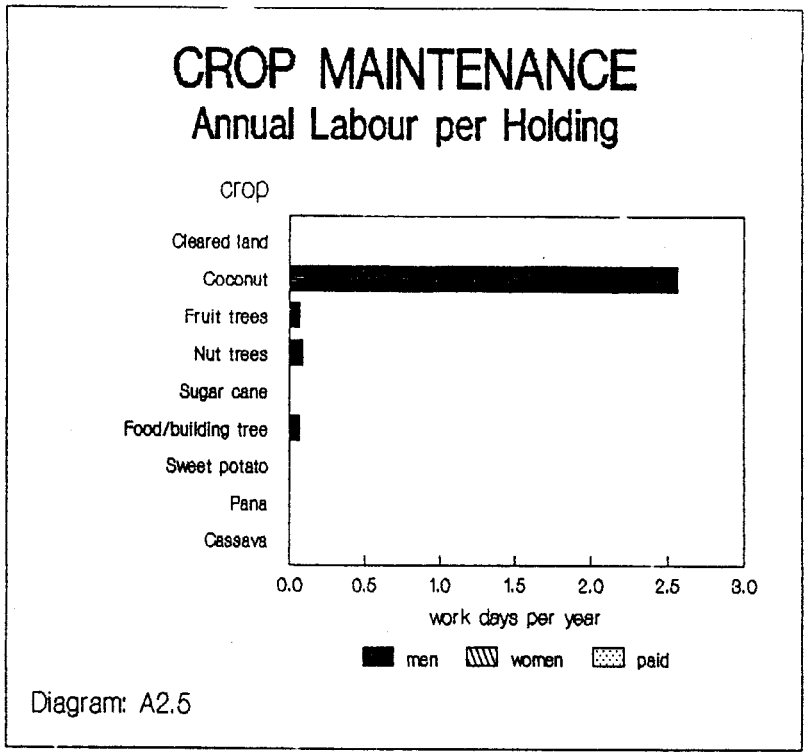


Diagram: A2.5

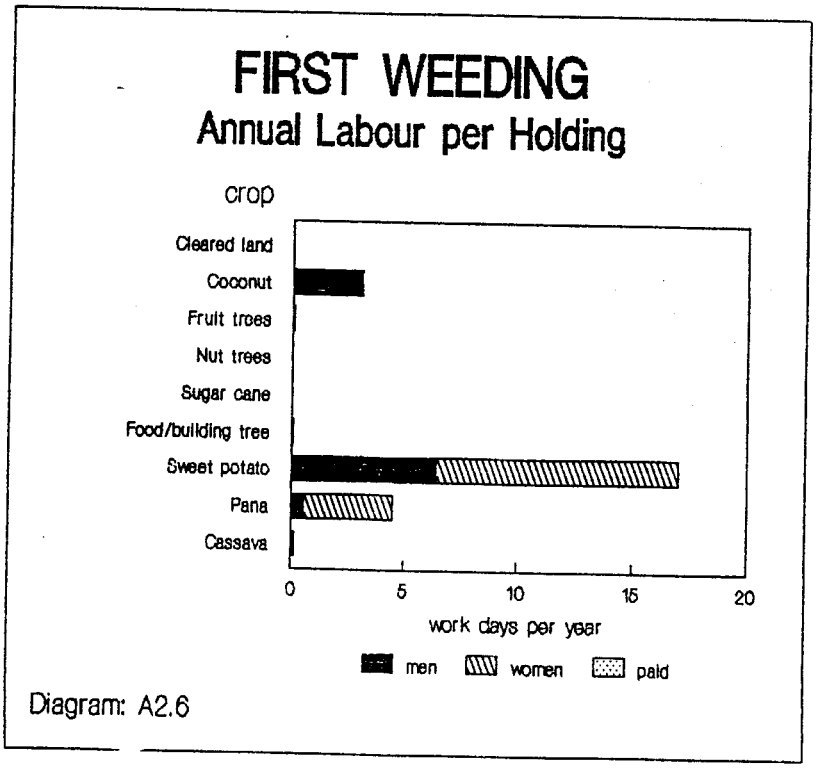


Diagram: A2.6

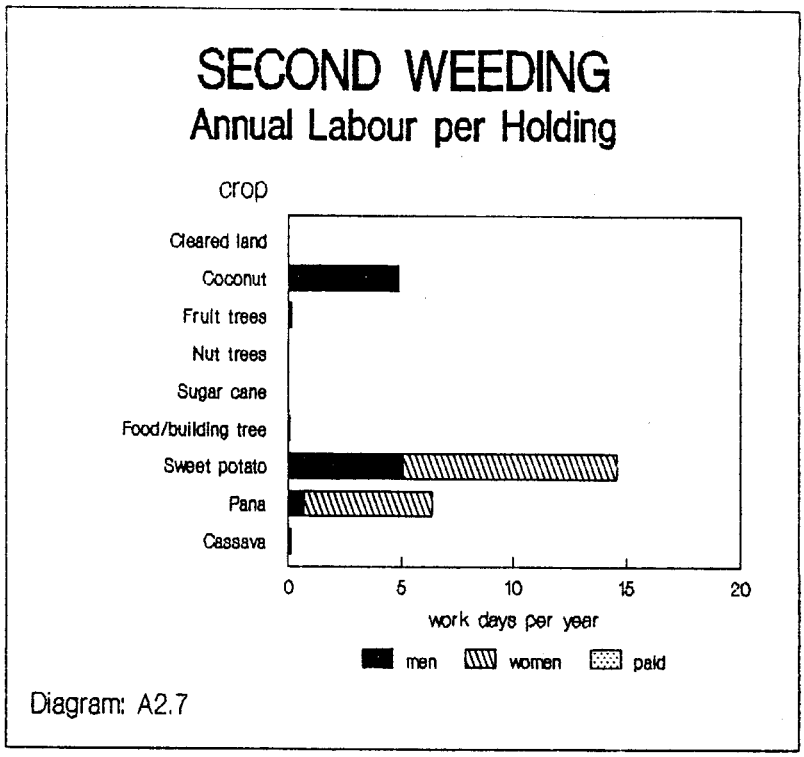


Diagram: A2.7

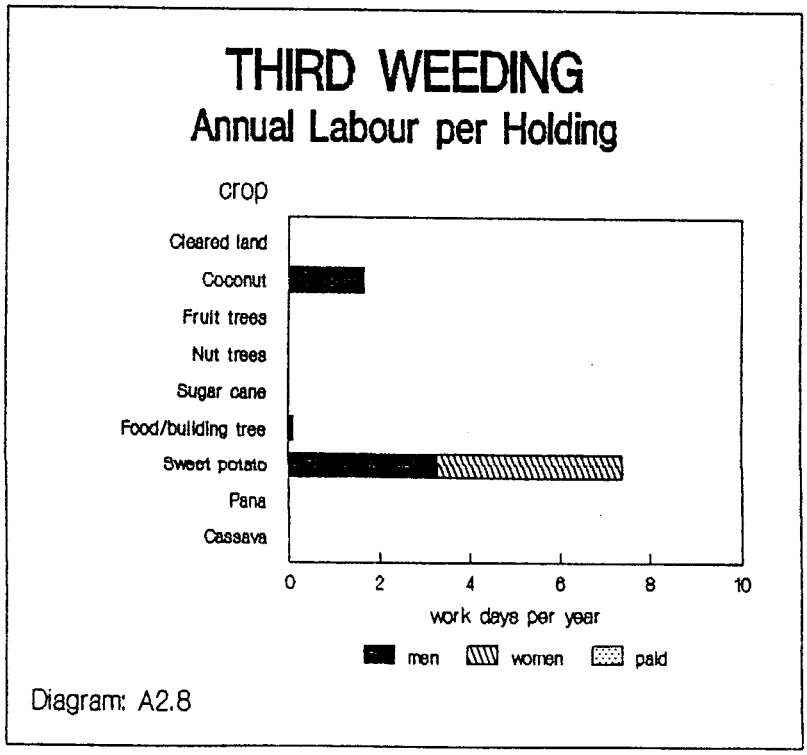


Diagram: A2.8

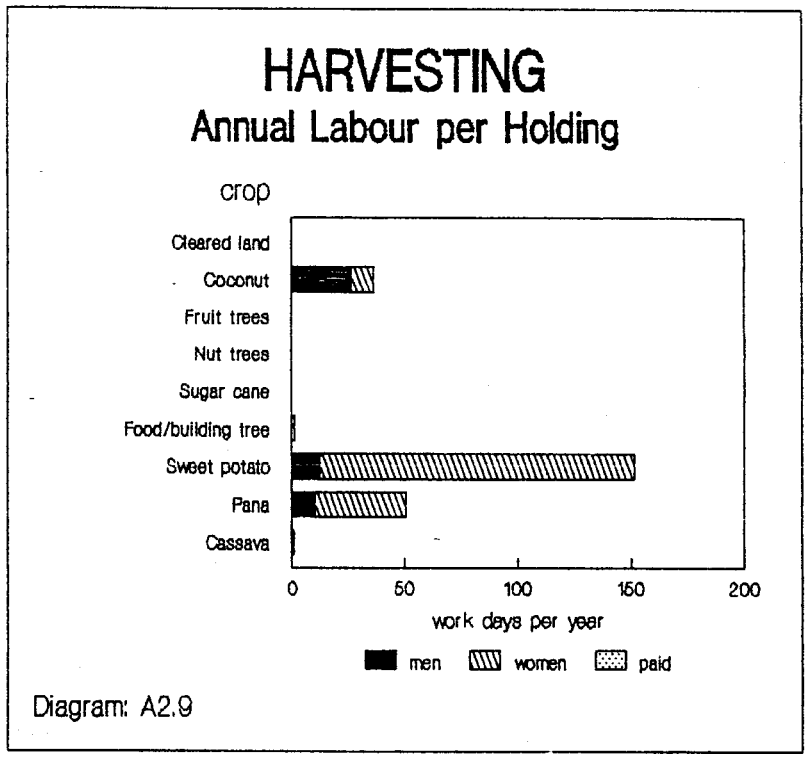

HARVESTING
Annual Labour per Holding
crop
Cleared land
Coconut
Fruit trees
Nut trees
Sugar cane
Food/building tree
Sweet potato
Pana
Cassava
0
50
100
150
200
work days per year
men
women
paid

Diagram: A2.9

Annex: 3
References

1 Statistics Office (1988)
Statistical Bulletin 3/88
"Solomon Islands Population Census.
Report 1: Population by Sex, Age and Ward"
Ministry of Finance.

2 Statistics Office (1988)
Statistical Bulletin 12/88
"Solomon Islands Population Census.
Report 1 (Supplement): Summary of Population
by Socio-Economic Characteristics"
Ministry of Finance.

3 Statistics Office (1987)
National Accounts Discussion Document No 2
"Rural Household Income and Expenditure Survey 1982"
Ministry of Finance.

4 Statistics Office (1986)
"Cattle Census 1985"
Statistical Bulletin 17/86
Ministry of Finance.

5 Statistics Office (1978)
"1974-75 Agricultural Statistics Survey"
Ministry of Finance.

6 Coconut Development Project (1985)
"Coconut Survey"
Ministry of Agriculture and Lands.

7 Statistics Office (1986)
"Sample Survey of Smallholder Coconuts, 1985"
Statistical Bulletin 18/86
Ministry of Finance.

8 S.Ilala, E.C. Mackey (1988)
"CEMA Trade and Marketing Project"
Commodities Export and Marketing Authority,
Rural Services Project, MAL.

9 R.J. Cheatle, V.P. Redfern (eds) (1988)
"Guide to the Soils, Land Resources and Land Use of
Guadalcanal"
Ministry of Agriculture and Lands.

10 J.R.F. Hansell, J.R.D. Wall (1976)
Land Resource Study 18
"Land Resources of the Solomon Islands"
Ministry of Overseas Development (U.K.).

11 Statistics Office (1987)
"Provincial Statistics"
Statistical Bulletin 15/87
Ministry of Finance.

12 Agricultural Economics Section (1988)
"Yield Measurement for Agricultural Economics Surveys"
Rural Services Project,
Ministry of Agriculture and Lands.

13 Research Department (1987)
"Annual Report 1985"
Agriculture Division,
Ministry of Agriculture and Lands.

14 Research Department (1986)
"Annual Report 1984"
Agriculture Division,
Ministry of Agriculture and Lands.

15 I.L. Frazer (1973)
"North Malaita Report"
Department of Geography, Victoria University,
New Zealand.

16 D.E. Gollifer (1972)
"Effect of Applications of Potassium on Annual Crops Grown on Soils of the Dala Series in Malaita, British Solomon Islands"
Tropical Agriculture (Trinidad) Vol.49, No. 3.

17 D.E. Gollifer (1969)
"Shifting Cultivation and Soil Exhaustion in West Kwara'ae, Malaita"
Report of the Interdepartmental Committee, Honiara.

18 M.A. Bathgate (1973)
"A Study of Economic Change and Development in the Indigenous Sector, West Guadalcanal"
Department of Geography, Victoria University,
New Zealand.

19 M. Chapman, P. Pirie (1974)
"Tasi Mauri, A Report on Population and Resources of the Guadalcanal Weather Coast"
University of Hawaii, U.S.A.

20 E.C. Mackey (1987)
"Inception Report"
Agricultural Economics Section, Rural Services Project,
Ministry of Agriculture and Lands.

21 Agricultural Economics Section (1987)
"Farming Systems Survey, Field Survey Manual"
Rural services Project,
Ministry of Agriculture and Lands.

22. Agricultural Economics Section (1988)
"Crop Production Study"
Rural Services Project,
Ministry of Agriculture and Lands.

23. A.E. Charles (1980)
"Constraints on the Use of High Yielding Varieties by Small Coconut Farmers"
Department of Primary Industry,
Papua New Guinea.

24. L.H. Patten, E.M. Flemming (1988)
"Farm Management Handbook for Solomon Islands - Draft"
South Pacific Smallholder Project.

25. K.Tioti (1967)
"Taro Cultivation in the Solomon Islands"
Pacific Root Crops Field Interchange.

26. D.E. Gollifer (1971)
"Preliminary Observations on the Performance of Cultivars of Taro in the British Solomon Islands"
DCRS Library.

27. L. Maeinia (undated)
"Yam and Pana Growing in Malaita Island"
Agricultural Training college,
Solomon Islands.

28. Dodo Creek Research Station (1982)
"Dala - Cassava Germplasm Collection Trial"
Ministry of Home Affairs and National Development.

29. S.Flemming (1987)
"Socio-Economic Statistics on Women:
Five Case Studies in the Pacific"
South Pacific Commission.

30. Agricultural Economics Section (1989)
"Selected Indicators From Ten Survey Areas of
the 1987-89 RSP Farming Systems Survey"
Ministry of Agriculture and Lands.

31. C.P. Henderson, J.M. Bonie (1988)
"The Revival of Temotu Traditional Agriculture
in the Reef Islands"
DCRS, Ministry of Agriculture and Lands.

32. R.J. Morrison (1987)
"Chemistry and Classification of Pacific Low Atoll Soils"
Alafua Agricultural Bulletin Vol 12, No 3
University of the South Pacific.

33. S. Caiger (1987)
"Coralline Soils of Tuvalu: Their Analytical Characteristics
and Fertilizer Requirements"
Alafua Agricultural Bulletin Vol 12, No 3
University of the South Pacific.

34 H.I. Manner (1987)
"Atoll Flora and Vegetation"
Alafua Agricultural Bulletin Vol 12, No 3
University of the South Pacific.

35. J.R. Finlay (1987)
"Applying Fertilizer on Atolls"
Alafua Agricultural Bulletin Vol 12, No 3
University of the South Pacific.

36 J. Newhouse (1987)
"What is an Atoll"
Alafua Agricultural Bulletin Vol 12, No 3
University of the South Pacific.